P-660HW-Tx v3

802.11g Wireless ADSL 2+ 4-port Gateway

User's Guide

Version 3.40
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Edition 1

DEFAULT LOGIN	
IP Address	**http://192.168.1.1**
User Password	**user**
Admin Password	**1234**

ZyXEL

www.zyxel.com

About This User's Guide

Intended Audience

This manual is intended for people who want to configure the ZyXEL Device using the web configurator. You should have at least a basic knowledge of TCP/IP networking concepts and topology.

Related Documentation

- Quick Start Guide
  The Quick Start Guide is designed to help you get up and running right away. It contains information on setting up your network and configuring for Internet access.

It is recommended you use the web configurator to configure the ZyXEL Device.

- Supporting Disc
  Refer to the included CD for support documents.
- ZyXEL Web Site
  Please refer to www.zyxel.com for additional support documentation and product certifications.

User's Guide Feedback

Help us help you. Send all User's Guide-related comments, questions or suggestions for improvement to the following address, or use e-mail instead. Thank you!

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Disclaimer

Graphics in this book may differ slightly from the product due to differences in operating systems, operating system versions, or if you installed updated firmware/software for your device. Every effort has been made to ensure that the information in this manual is accurate.

Document Conventions

Warnings and Notes

These are how warnings and notes are shown in this User's Guide.

Warnings tell you about things that could harm you or your ZyXEL Device.

Notes tell you other important information (for example, other things you may need to configure or helpful tips) or recommendations.

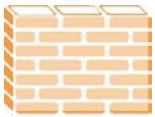
Syntax Conventions

- The P-660HW-Tx v3 may be referred to as the "ZyXEL Device", the "device", the "system" or the "product" in this User's Guide.
- Product labels, screen names, field labels and field choices are all in **bold** font.
- A key stroke is denoted by square brackets and uppercase text, for example, [ENTER] means the "enter" or "return" key on your keyboard.
- "Enter" means for you to type one or more characters and then press the [ENTER] key. "Select" or "choose" means for you to use one of the predefined choices.
- A right angle bracket (>) within a screen name denotes a mouse click. For example, **Maintenance > Log > Log Setting** means you first click **Maintenance** in the navigation panel, then the **Log** sub menu and finally the **Log Setting** tab to get to that screen.
- Units of measurement may denote the "metric" value or the "scientific" value. For example, "k" for kilo may denote "1000" or "1024", "M" for mega may denote "1000000" or "1048576" and so on.
- "e.g.," is a shorthand for "for instance", and "i.e.," means "that is" or "in other words".

Icons Used in Figures

Figures in this User's Guide may use the following generic icons. The ZyXEL Device icon is not an exact representation of your ZyXEL Device.

Table 1 Common Icons

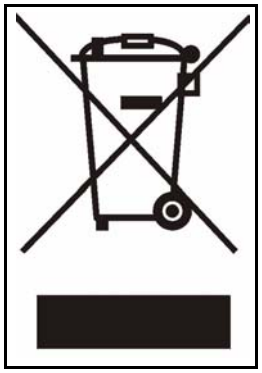
ZyXEL Device	Computer	Notebook
Server	DSLAM	Firewall 
Switch	Router	Internet Cloud
Wireless Signal	Telephone	

Safety Warnings

For your safety, be sure to read and follow all warning notices and instructions.

- Do NOT use this product near water, for example, in a wet basement or near a swimming pool.
- Do NOT expose your device to dampness, dust or corrosive liquids.
- Do NOT store things on the device.
- Do NOT install, use, or service this device during a thunderstorm. There is a remote risk of electric shock from lightning.
- Connect ONLY suitable accessories to the device.
- Do NOT open the device or unit. Opening or removing covers can expose you to dangerous high voltage points or other risks. ONLY qualified service personnel should service or disassemble this device. Please contact your vendor for further information.
- Make sure to connect the cables to the correct ports.
- Place connecting cables carefully so that no one will step on them or stumble over them.
- Always disconnect all cables from this device before servicing or disassembling.
- Use ONLY an appropriate power adaptor or cord for your device. Connect it to the right supply voltage (for example, 110V AC in North America or 230V AC in Europe).
- Do NOT allow anything to rest on the power adaptor or cord and do NOT place the product where anyone can walk on the power adaptor or cord.
- Do NOT use the device if the power adaptor or cord is damaged as it might cause electrocution.
- If the power adaptor or cord is damaged, remove it from the device and the power source.
- Do NOT attempt to repair the power adaptor or cord. Contact your local vendor to order a new one.
- Do not use the device outside, and make sure all the connections are indoors. There is a remote risk of electric shock from lightning.
- Do NOT obstruct the device ventilation slots, as insufficient airflow may harm your device.
- Use only No. 26 AWG (American Wire Gauge) or larger telecommunication line cord.
- Antenna Warning! This device meets ETSI and FCC certification requirements when using the included antenna(s). Only use the included antenna(s).
- If you wall mount your device, make sure that no electrical lines, gas or water pipes will be damaged.

Your product is marked with this symbol, which is known as the WEEE mark. WEEE stands for Waste Electronics and Electrical Equipment. It means that used electrical and electronic products should not be mixed with general waste. Used electrical and electronic equipment should be treated separately.



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PART I
Introduction

Introducing the ZyXEL Device (33)
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1

Introducing the ZyXEL Device

This chapter introduces the main applications and features of the ZyXEL Device. It also introduces the ways you can manage the ZyXEL Device.

1.1 Overview

The ZyXEL Device is an is an ADSL2+ gateway that allows super-fast, secure Internet access over analog (POTS) or digital (ISDN) telephone lines (depending on your model).

In the ZyXEL Device product name, “H” denotes an integrated 4-port switch (hub) and “W” denotes an included wireless LAN card that provides wireless connectivity.

Model names ending in “1”, for example P-660HW-T1, denote a device that works over the analog telephone system, POTS (Plain Old Telephone Service). Model names ending in “3” denote a device that works over ISDN (Integrated Services Digital Network).

The DSL RJ-11 (ADSL over POTS models) or RJ-45 (ADSL over ISDN models) connects to your ADSL-enabled telephone line.

Only use firmware for your ZyXEL Device’s specific model. Refer to the label on the bottom of your ZyXEL Device.

Connect your computer(s) to the ZyXEL Device. The ZyXEL Device uses the phone line to provide high-speed Internet access to the computer(s). You can continue to use the phone line for regular phone calls as well. See the Quick Start Guide for instructions to make these connections.

1.2 Ways to Manage the ZyXEL Device

Use any of the following methods to manage the ZyXEL Device.

- Web Configurator. This is recommended for everyday management of the ZyXEL Device using a (supported) web browser. See Chapter 2 on page 45.
- FTP. Use File Transfer Protocol for firmware upgrades and configuration backup/restore.
- SPTGEN. SPTGEN is a text configuration file that you can edit and upload to the ZyXEL Device. This is especially convenient if you need to configure many ZyXEL Devices of the same type. See Appendix G on page 357.

- TR-069. This is a standard that defines how your ZyXEL Device can be managed by a management server.

1.3 Configuring Your ZyXEL Device's Security Features

Your ZyXEL Device comes with a variety of security features. This section summarizes these features and provides links to sections in the User's Guide to configure security settings on your ZyXEL Device. Follow the suggestions below to improve security on your ZyXEL Device and network.

1.3.1 Control Access to Your Device

Ensure only people with permission can access your ZyXEL Device.

- Control physical access by locating devices in secure areas, such as locked rooms. Most ZyXEL Devices have a reset button. If an unauthorized person has access to the reset button, they can then reset the device's password to its default password, log in and reconfigure its settings.
- Change any default passwords on the ZyXEL Device, such as the password used for accessing the ZyXEL Device's web configurator (if it has a web configurator). Use a password with a combination of letters and numbers and change your password regularly. Write down the password and put it in a safe place.
- Avoid setting a long timeout period before the ZyXEL Device's web configurator automatically times out. A short timeout reduces the risk of unauthorized person accessing the web configurator while it is left idle.

See Chapter 19 on page 247 for instructions on changing your password and setting the timeout period.

- Configure remote management to control who can manage your ZyXEL Device. See Chapter 17 on page 221 for more information. If you enable remote management, ensure you have enabled remote management only on the IP addresses, services or interfaces you intended and that other remote management settings are disabled.

1.3.2 Wireless Security

Wireless devices are especially vulnerable to attack. If your ZyXEL Device has a wireless function, take the following measures to improve wireless security.

- Enable wireless security on your ZyXEL Device. Choose the most secure encryption method that all devices on your network support. See Chapter 9 on page 127 for directions on configuring encryption. If you have a RADIUS server, enable WPA(2) user identification on your network so users must log in. This method is more common in business environments.
- Use WPS's PIN method to set up your wireless network instead of using the push-button method. The PIN method is more secure than the push-button method as it ensures only selected devices are added to your wireless network. See Section 9.5 on page 145 for more information on using the WPS PIN method.

- Hide your wireless network name (SSID). The SSID can be regularly broadcast and unauthorized users may use this information to access your network. See Chapter 9 on page 127 for directions on using the web configurator to hide the SSID.
- Enable the MAC filter to allow only trusted users to access your wireless network or deny unwanted users access based on their MAC address. See Section 9.2.2 on page 128 for directions on configuring the MAC filter.

1.3.3 Firewall

See Chapter 12 on page 173 for more information on the following security measures.

- Ensure the firewall is turned on. Traffic initiated from your WAN is blocked by default.
- Set the firewall to block ICMP requests.
- Enable do not respond to requests for unauthorized services.
- If you have a backup gateway (for example, backup Internet access) on your network, disable the Bypass Triangle Routes feature and enable IP Alias to put your backup gateway on a different subnet.
- Avoid raising the maximum number of NAT sessions per host unnecessarily as it increases the possibility of unauthorized connections, such as connections caused by a computer virus.

1.3.4 NAT

- Enable NAT (Network Address Translation) to make devices on your network “invisible” to those outside your network (unless you configure port-forwarding rules for them).
- Applications such as games or file-sharing can be configured so they are visible from other networks by using port-forwarding. Ensure only applications you want are configured to port-forward.

See Chapter 10 on page 147 for instructions on these measures.

1.3.5 Content filter

- You can block web services including cookies, ActiveX and Java. While these services can be misused, they can also enhance the functionality of a website. To block these services, follow the instructions in Chapter 13 on page 195.

1.3.6 UPnP

- Disable UPnP (Universal Plug and Play) unless you specifically want applications (for example, games or file-sharing applications) on your network to pass through your firewall unchecked.

1.4 Maintaining Your ZyXEL Device

Do the following things regularly to keep your ZyXEL Device running.

- Check the ZyXEL website (www.zyxel.com.tw) regularly for new firmware for your ZyXEL Device. Ensure you download the correct firmware for your model.

- Back up the configuration (and make sure you know how to restore it). Restoring an earlier working configuration may be useful if the device becomes unstable or even crashes. If you forget your password, you will have to reset the ZyXEL Device to its factory default settings. If you backed up an earlier configuration file, you would not have to totally re-configure the ZyXEL Device. You could simply restore your last configuration.

1.5 Features

High Speed Internet Access

The ZyXEL Device is compatible with the ADSL/ADSL2/ADSL2+ standards. Maximum data rates attainable for each standard are shown in the next table.

Table 2 ADSL Standards

DATA RATE STANDARD	UPSTREAM	DOWNSTREAM
ADSL	832 kbps	8Mbps
ADSL2	3.5Mbps	12Mbps
ADSL2+	3.5Mbps	24Mbps

If your ZyXEL Device does not support Annex M, the maximum ADSL2/2+ upstream data rate is 1.2 Mbps. ZyXEL Devices which work over ISDN do not support Annex M.

The standard your ISP supports determines the maximum upstream and downstream speeds attainable. Actual speeds attained also depend on the distance from your ISP, line quality, etc.

Triple Play Service

The ZyXEL Device is a Triple Play Gateway, capable of simultaneously transferring data, voice and video over the Internet. The Gateway possesses advanced Quality of Service (QoS) features to provide a high standard of Triple Play delivery.

Zero Configuration Internet Access

Once you connect and turn on the ZyXEL Device, it automatically detects the Internet connection settings (such as the VCI/VPI numbers and the encapsulation method) from the ISP and makes the necessary configuration changes. In cases where additional account information (such as an Internet account user name and password) is required or the ZyXEL Device cannot connect to the ISP, you will be redirected to web screen(s) for information input or troubleshooting.

Any IP

The Any IP feature allows a computer to access the Internet and the ZyXEL Device without changing the network settings (such as IP address and subnet mask) of the computer, when the IP addresses of the computer and the ZyXEL Device are not in the same subnet.

Firewall

The ZyXEL Device is a stateful inspection firewall with DoS (Denial of Service) protection. By default, when the firewall is activated, all incoming traffic from the WAN to the LAN is blocked unless it is initiated from the LAN. The ZyXEL Device firewall supports TCP/UDP inspection, DoS detection and prevention, real time alerts, reports and logs.

Content Filtering

Content filtering allows you to block access to forbidden Internet web sites, schedule when the ZyXEL Device should perform the filtering and give trusted LAN IP addresses unfiltered Internet access.

Traffic Redirect

Traffic redirect forwards WAN traffic to a backup gateway when the ZyXEL Device cannot connect to the Internet, thus acting as an auxiliary if your regular WAN connection fails.

Media Bandwidth Management

ZyXEL's Media Bandwidth Management allows you to specify bandwidth classes based on an application and/or subnet. You can allocate specific amounts of bandwidth capacity (bandwidth budgets) to different bandwidth classes.

Universal Plug and Play (UPnP)

Using the standard TCP/IP protocol, the ZyXEL Device and other UPnP enabled devices can dynamically join a network, obtain an IP address and convey its capabilities to other devices on the network.

PPPoE (RFC2516)

PPPoE (Point-to-Point Protocol over Ethernet) emulates a dial-up connection. It allows your ISP to use their existing network configuration with newer broadband technologies such as ADSL. The PPPoE driver on the ZyXEL Device is transparent to the computers on the LAN, which see only Ethernet and are not aware of PPPoE thus saving you from having to manage PPPoE clients on individual computers. The ZyXEL Device also includes PPPoE idle time-out (the PPPoE connection terminates after a period of no traffic that you configure) and PPPoE Dial-on-Demand (the PPPoE connection is brought up only when an Internet access request is made).

Network Address Translation (NAT)

Network Address Translation (NAT) allows the translation of an Internet Protocol address used within one network (for example a private IP address used in a local network) to a different IP address known within another network (for example a public IP address used on the Internet).

Dynamic DNS Support

With Dynamic DNS support, you can have a static hostname alias for a dynamic IP address, allowing the host to be more easily accessible from various locations on the Internet. You must register for this service with a Dynamic DNS service provider.

DHCP

DHCP (Dynamic Host Configuration Protocol) allows the individual clients (computers) to obtain the TCP/IP configuration at start-up from a centralized DHCP server. The ZyXEL Device has built-in DHCP server capability enabled by default. It can assign IP addresses, an IP default gateway and DNS servers to DHCP clients. The ZyXEL Device can now also act as a surrogate DHCP server (DHCP Relay) where it relays IP address assignment from the actual real DHCP server to the clients.

IP Alias

IP Alias allows you to partition a physical network into logical networks over the same Ethernet interface. The ZyXEL Device supports three logical LAN interfaces via its single physical Ethernet interface with the ZyXEL Device itself as the gateway for each LAN network.

TR-069 Compliance

TR-069 is a DSL Forum standard that defines how CPE (Customer Premise Equipment), for example your ZyXEL Device, can be managed over the WAN by an Auto Configuration Server (ACS) such as ZyXEL's CNM Access. TR-069 is based on sending RPCs (Remote Procedure Call) between an ACS and a client device. RPCs are sent in XML (Extensible Markup Language) format over HTTP or HTTPS.

Housing

Your ZyXEL Device's compact and ventilated housing minimizes space requirements making it easy to position anywhere in your busy office.

4-port Switch

A combination of switch and router makes your ZyXEL Device a cost-effective and viable network solution. You can connect up to four computers to the ZyXEL Device without the cost of a hub. Use a hub to add more than four computers to your LAN.

1.5.1 Wireless Features

Wireless LAN

The ZyXEL Device supports the IEEE 802.11g standard, which is fully compatible with the IEEE 802.11b standard, meaning that you can have both IEEE 802.11b and IEEE 802.11g wireless clients in the same wireless network.

The ZyXEL Device may be prone to RF (Radio Frequency) interference from other 2.4 GHz devices such as microwave ovens, wireless phones, Bluetooth enabled devices, and other wireless LANs.

Wi-Fi Protected Access

Wi-Fi Protected Access (WPA) is a subset of the IEEE 802.11i security specification standard. Key differences between WPA and WEP are user authentication and improved data encryption.

WPA2

WPA 2 (IEEE 802.11i) is a wireless security standard that defines stronger encryption, authentication and key management than WPA.

Both WPA and WPA2 improve data encryption by using Temporal Key Integrity Protocol (TKIP), Message Integrity Check (MIC) and IEEE 802.1x. In addition to TKIP, WPA2 also uses Advanced Encryption Standard (AES) in the Counter mode with Cipher block chaining Message authentication code Protocol (CCMP) to offer stronger encryption.

Antenna

The ZyXEL Device is equipped with one 3dBi fixed antenna to provide clear radio signal between the wireless stations and the access points.

WEP Encryption

WEP (Wired Equivalent Privacy) encrypts data frames before transmitting over the wireless network to help keep network communications private.

Output Power Management

Output power management is the ability to set the level of output power.

There may be interference or difficulty with channel assignment when there is a high density of APs within a coverage area. In this case you can lower the output power of each access point, thus enabling you to place access points closer together.

Wireless LAN MAC Address Filtering

Your ZyXEL Device can check the MAC addresses of wireless stations against a list of allowed or denied MAC addresses.

1.6 Applications for the ZyXEL Device

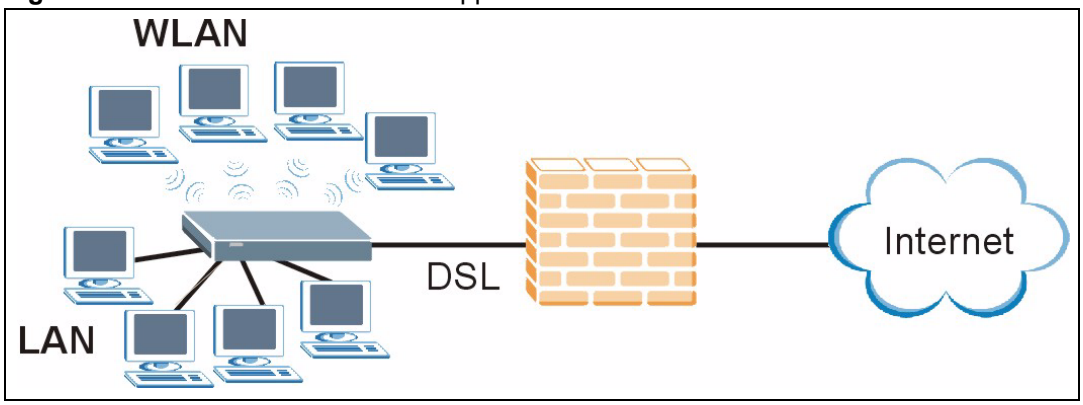
Here are some example uses for which the ZyXEL Device is well suited.

1.6.1 Protected Internet Access

The ZyXEL Device is the ideal high-speed Internet access solution. It is compatible with all major ADSL DSLAM (Digital Subscriber Line Access Multiplexer) providers and supports the ADSL standards as shown in Table 2 on page 36. In addition, the ZyXEL Device with the wireless features allows wireless clients access to your network resources.

The ZyXEL Device provides protection from attacks by Internet hackers. By default, the firewall blocks all incoming traffic from the WAN. The firewall supports TCP/UDP inspection and DoS (Denial of Services) detection and prevention, as well as real time alerts, reports and logs.

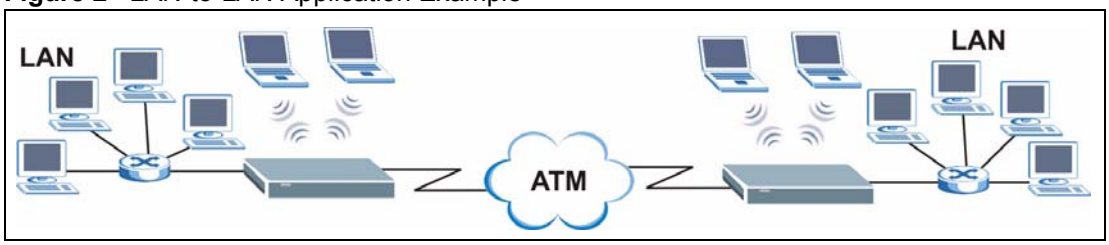
Figure 1 Protected Internet Access Applications



1.6.2 LAN to LAN Application

You can use the ZyXEL Device to connect two geographically dispersed networks over the ADSL line. A typical LAN-to-LAN application example is shown as follows.

Figure 2 LAN-to-LAN Application Example



1.7 LEDs

Figure 3 LEDs

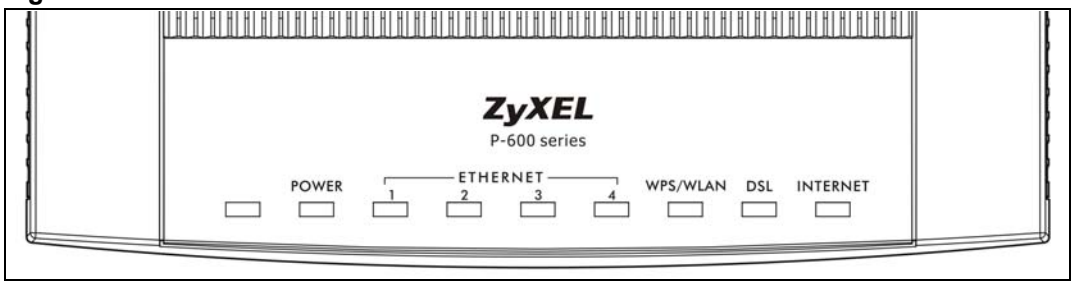


Table 3 LEDs

LED	COLOR	STATUS	DESCRIPTION
POWER	Green	On	The ZyXEL Device is receiving power and functioning properly.
		Blinking	The ZyXEL Device is booting or performing diagnostics.
	Red	On	Power to the ZyXEL Device is too low.
		Off	The system is not ready or has malfunctioned.
ETHERNET 1,2,3,4	Green	On	The ZyXEL Device has a successful Ethernet connection.
		Blinking	The ZyXEL Device is sending/receiving data.
		Off	The ZyXEL Device is not connected to the LAN.
WPS/WLAN	Green	On	The wireless network is activated.
		Blinking	The ZyXEL Device is sending/receiving data through the wireless LAN.
	Orange	Blinking	The ZyXEL Device is setting up a WPS connection.
		Off	The wireless LAN is not ready or has failed.
DSL	Green	On	The DSL line is up.
		Blinking	The ZyXEL Device is initializing the DSL line.
		Off	The DSL line is down.
INTERNET	Green	On	The Internet connection is up.
		Blinking	The ZyXEL Device is sending/receiving data.
		Off	The Internet connection is down.

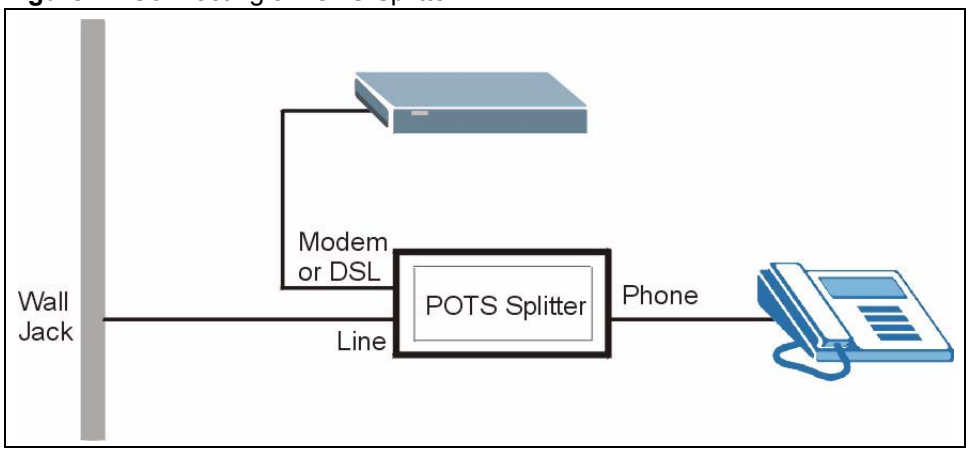
1.8 Splitters and Microfilters

1.8.1 Connecting a POTS Splitter

When you use the Full Rate (G.dmt) ADSL standard, you can use a POTS (Plain Old Telephone Service) splitter to separate the telephone and ADSL signals. This allows simultaneous Internet access and telephone service on the same line. A splitter also eliminates the destructive interference conditions caused by telephone sets.

Install the POTS splitter at the point where the telephone line enters your residence, as shown in the following figure.

Figure 4 Connecting a POTS Splitter



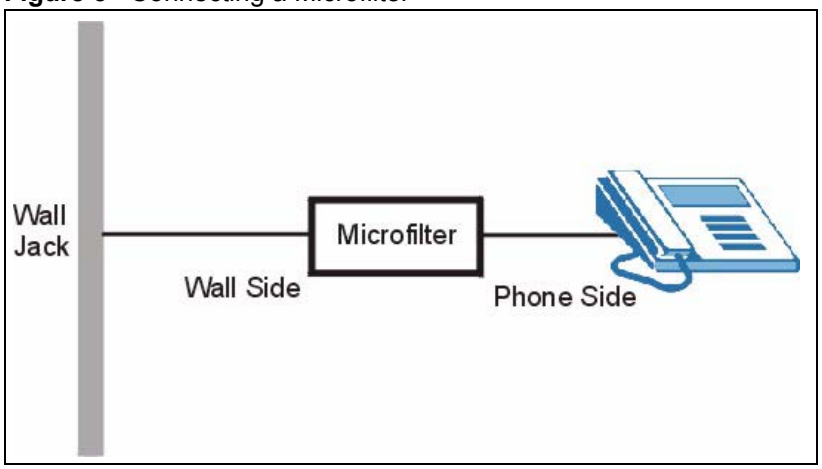
1. Connect the side labeled “Phone” to your telephone.
2. Connect the side labeled “Modem” or “DSL” to your ZyXEL Device.
3. Connect the side labeled “Line” to the telephone wall jack.

1.8.2 Telephone Microfilters

Telephone voice transmissions take place in the lower frequency range, 0 - 4KHz, while ADSL transmissions take place in the higher bandwidth range, above 4KHz. A microfilter acts as a low-pass filter, for your telephone, to ensure that ADSL transmissions do not interfere with your telephone voice transmissions. The use of a telephone microfilter is optional.

1. Locate and disconnect each telephone.
2. Connect a cable from the wall jack to the “wall side” of the microfilter.
3. Connect the “phone side” of the microfilter to your telephone as shown in the following figure.
4. After you are done, make sure that your telephone works. If your telephone does not work, disconnect the microfilter and contact either your local telephone company or the provider of the microfilter.

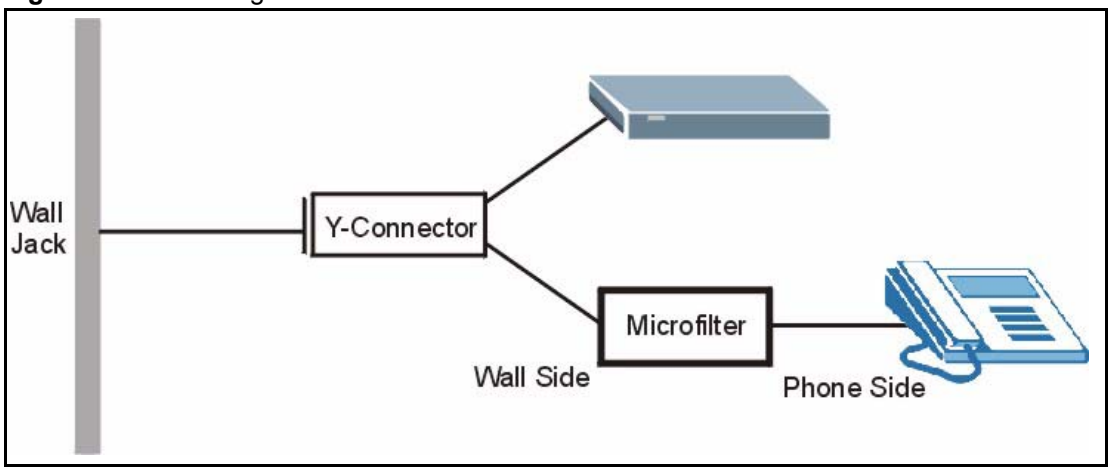
Figure 5 Connecting a Microfilter



You can also use a Y-Connector with a microfilter in order to connect both your modem and a telephone to the same wall jack without using a POTS splitter.

1. Connect a phone cable from the wall jack to the single jack end of the Y-Connector.
2. Connect a cable from the double jack end of the Y-Connector to the "wall side" of the microfilter.
3. Connect another cable from the double jack end of the Y-Connector to the ZyXEL Device.
4. Connect the "phone side" of the microfilter to your telephone as shown in the following figure.

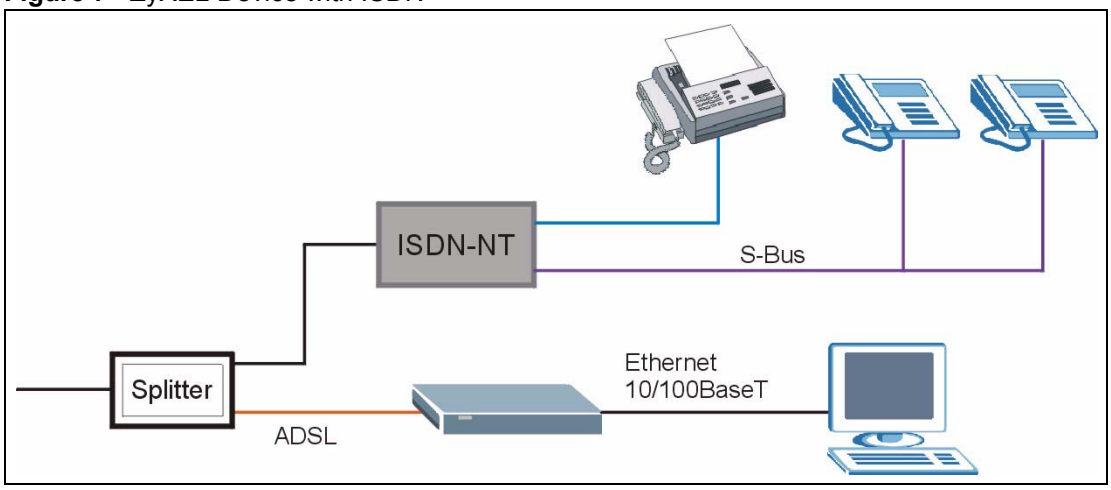
Figure 6 Connecting a Microfilter and Y-Connector



ZyXEL Device With ISDN

This section relates to people who use their ZyXEL Device with ADSL over ISDN (digital telephone service) only. The following is an example installation for the ZyXEL Device with ISDN.

Figure 7 ZyXEL Device with ISDN



2

Introducing the Web Configurator

This chapter describes how to access and navigate the web configurator.

2.1 Web Configurator Overview

The web configurator is an HTML-based management interface that allows easy ZyXEL Device setup and management via Internet browser. Use Internet Explorer 6.0 and later or Netscape Navigator 7.0 and later versions. The recommended screen resolution is 1024 by 768 pixels.

In order to use the web configurator you need to allow:

- Web browser pop-up windows from your device. Web pop-up blocking is enabled by default in Windows XP SP (Service Pack) 2.
- JavaScripts (enabled by default).
- Java permissions (enabled by default).

See the chapter on troubleshooting if you need to make sure these functions are allowed in Internet Explorer.

2.2 Accessing the Web Configurator

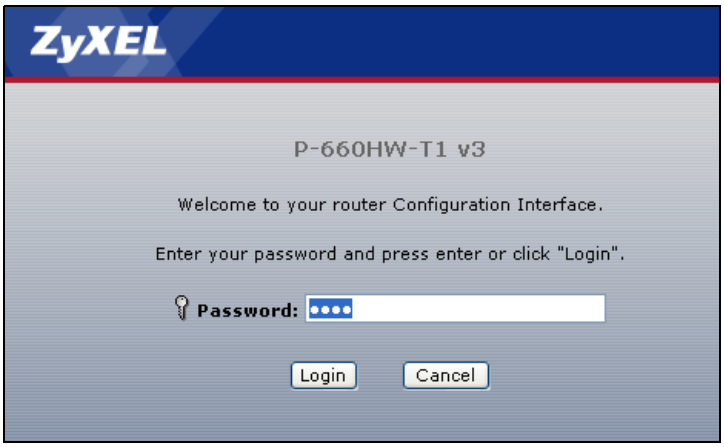
Even though you can connect to the ZyXEL Device wirelessly, it is recommended that you connect your computer to a LAN port for initial configuration.

1. Make sure your ZyXEL Device hardware is properly connected (refer to the Quick Start Guide).
2. Prepare your computer/computer network to connect to the ZyXEL Device (refer to the Quick Start Guide).
3. Launch your web browser.

4 Type "192.168.1.1" as the URL.

5 A window displays as shown. Enter the default admin password **1234** to configure the wizards and the advanced features or enter the default user password **user** to view the status only. Click **Login** to proceed to a screen asking you to change your password or click **Cancel** to revert to the default password.

Figure 8 Password Screen



6 If you entered the user password, skip the next two steps and refer to Section 2.4.2 on page 50 for more information about the **Status** screen.

If you entered the admin password, it is highly recommended you change the default admin password. Enter a new password between 1 and 30 characters, retype it to confirm and click **Apply**. Alternatively click **Ignore** to proceed to the main menu if you do not want to change the password now.

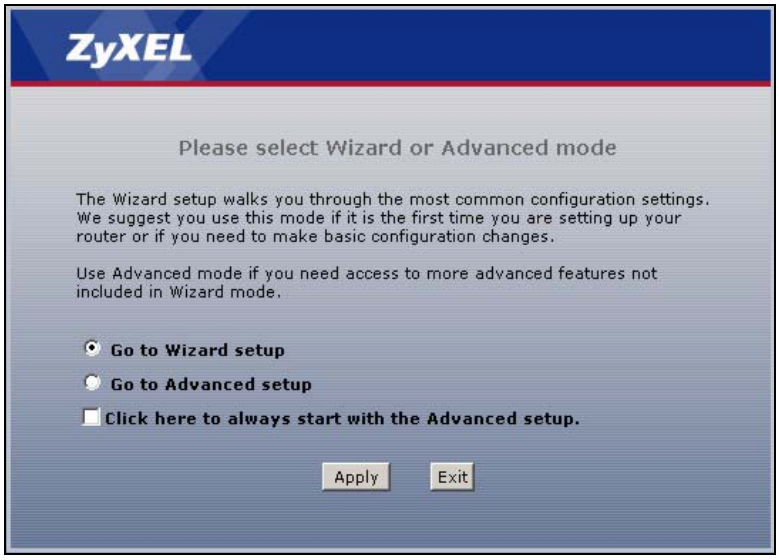
If you do not change the password at least once, the following screen appears every time you log in with the admin password.

Figure 9 Change Password at Login

ZyXEL
Use this screen to change the password.
Your router is currently using the default password. To protect your network from unauthorized users we suggest you change your password at this time. Please select a new password that will be easy to remember yet difficult for others to guess. We suggest you combine text with numbers to make it more difficult for an intruder to guess.
Enter your new password in the two fields below and click "Apply". Otherwise click "Ignore" to keep the default password
New Password:
Retype to Confirm:
Apply
Ignore

7 Select **Go to Wizard setup** and click **Apply** to display the wizard main screen. Otherwise, select **Go to Advanced setup** and click **Apply** to display the **Status** screen.

Figure 10 Select a Mode


ZyXEL
Please select Wizard or Advanced mode
The Wizard setup walks you through the most common configuration settings. We suggest you use this mode if it is the first time you are setting up your router or if you need to make basic configuration changes.
Use Advanced mode if you need access to more advanced features not included in Wizard mode.
Go to Wizard setup
Go to Advanced setup
Click here to always start with the Advanced setup.
Apply
Exit

The management session automatically times out when the time period set in the **Administrator Inactivity Timer** field expires (default five minutes). Simply log back into the ZyXEL Device if this happens to you.

2.3 Resetting the ZyXEL Device

If you forget your password or cannot access the web configurator, you will need to use the **RESET** button at the back of the ZyXEL Device to reload the factory-default configuration file. This means that you will lose all configurations that you had previously and the password will be reset to "1234".

2.3.1 Using the Reset Button

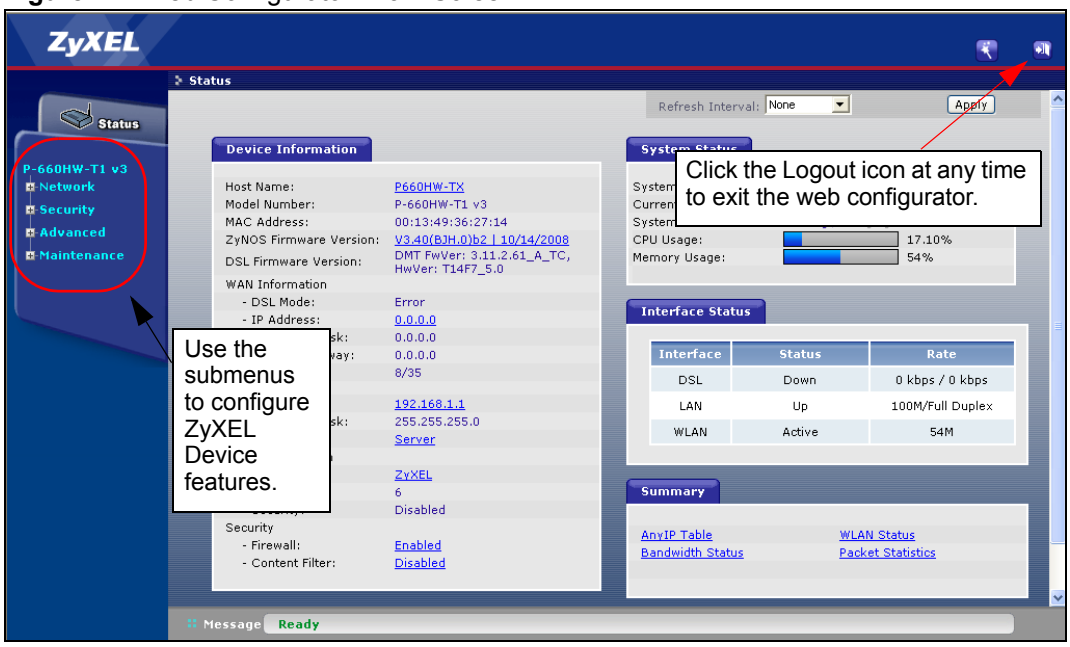
1. Make sure the **POWER** LED is on (not blinking).
2. Press the **RESET** button for ten seconds or until the **POWER** LED begins to blink and then release it. When the **POWER** LED begins to blink, the defaults have been restored and the ZyXEL Device restarts.

2.4 Navigating the Web Configurator

2.4.1 Navigation Panel

After you enter the admin password, use the sub-menus on the navigation panel to configure ZyXEL Device features. The following table describes the sub-menus.

Figure 11 Web Configurator: Main Screen



The following table describes the labels in this screen.

Table 4 Web Configurator Screens Summary

LINK/ICON	SUB-LINK	FUNCTION
Wizard	INTERNET/ WIRELESS SETUP	Use these screens for initial configuration including general setup, ISP parameters for Internet Access and WAN IP/DNS Server/MAC address assignment.
	BANDWIDTH MANAGEMENT SETUP	Use these screens to limit bandwidth usage by application or packet type.
Logout		Click this icon to exit the web configurator.
Status		This screen shows the ZyXEL Device's general device, system and interface status information. Use this screen to access the summary statistics tables.
Network		
WAN	Internet Connection	This screen allows you to configure ISP parameters, WAN IP address assignment, DNS servers and other advanced properties.
	More Connections	Use this screen to view and configure other connections for placing calls to another remote gateway.
	WAN Backup Setup	Use this screen to configure your traffic redirect properties and WAN backup settings.
LAN	IP	Use this screen to configure LAN TCP/IP settings, enable Any IP and other advanced properties.
	DHCP Setup	Use this screen to configure LAN DHCP settings.
	Client List	Use this screen to view current DHCP client information and to always assign an IP address to a MAC address (and host name).
	IP Alias	Use this screen to partition your LAN interface into subnets.
Wireless LAN	General	Use this screen to configure the wireless LAN settings and WLAN authentication/security settings.
	WPS	Use this screen to configure WPS (Wi-Fi Protected Setup) settings.
	WPS Station	Use this screen to set up a WPS wireless network.
NAT	General	Use this screen to enable NAT.
	Port Forwarding	Use this screen to configure servers behind the ZyXEL Device.
Security		
Firewall	General	Use this screen to activate/deactivate the firewall and the direction of network traffic to which to apply the rule.
	Rules	This screen shows a summary of the firewall rules, and allows you to edit/add a firewall rule.
	Anti Probing	Use this screen to change your anti-probing settings.
	Threshold	Use this screen to configure the threshold for DoS attacks.
Content Filter	Keyword	Use this screen to block sites containing certain keywords in the URL.
	Schedule	Use this screen to set the days and times for the ZyXEL Device to perform content filtering.
	Trusted	Use this screen to exclude a range of users on the LAN from content filtering on your ZyXEL Device.

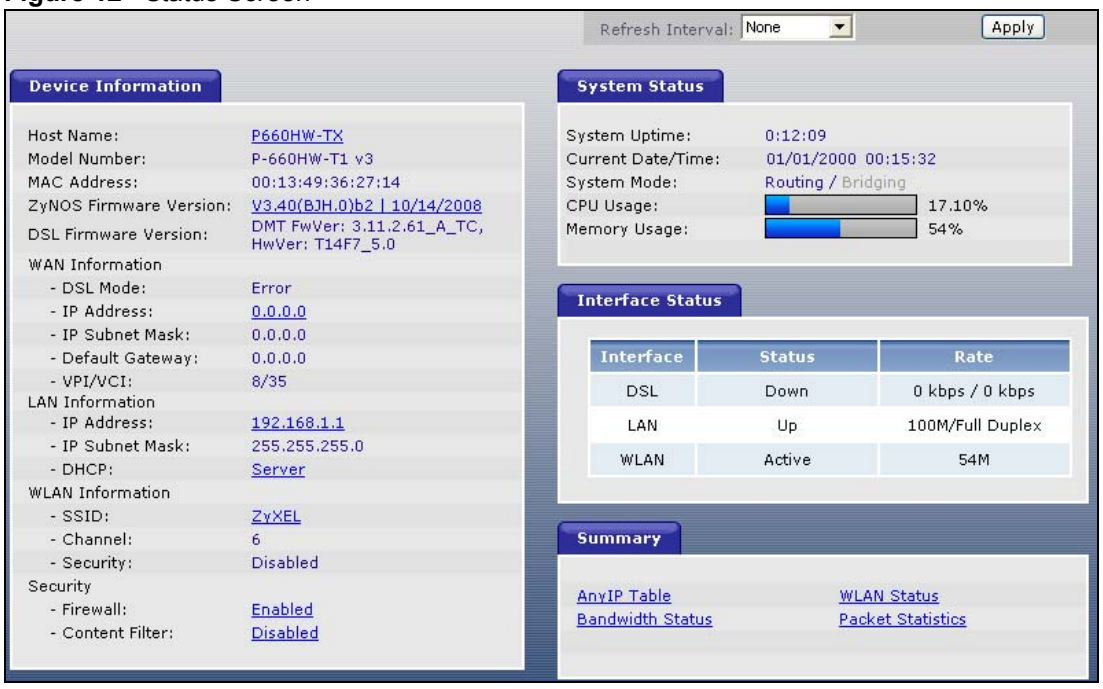
Table 4 Web Configurator Screens Summary (continued)

LINK/ICON	SUB-LINK	FUNCTION
Advanced		
Static Route		Use this screen to configure IP static routes.
Bandwidth MGMT	Summary	Use this screen to enable bandwidth management on an interface.
	Rule Setup	Use this screen to define a bandwidth rule.
	Monitor	Use this screen to view the ZyXEL Device's bandwidth usage and allotments.
Dynamic DNS		Use this screen to set up dynamic DNS.
Remote MGMT	WWW	Use this screen to configure through which interface(s) and from which IP address(es) users can use HTTPS or HTTP to manage the ZyXEL Device.
	Telnet	Use this screen to configure through which interface(s) and from which IP address(es) users can use Telnet to manage the ZyXEL Device.
	FTP	Use this screen to configure through which interface(s) and from which IP address(es) users can use FTP to access the ZyXEL Device.
	SNMP	Use this screen to configure your ZyXEL Device's settings for Simple Network Management Protocol management.
	DNS	Use this screen to configure through which interface(s) and from which IP address(es) users can send DNS queries to the ZyXEL Device.
	ICMP	Use this screen to change your anti-probing settings.
UPnP		Use this screen to enable UPnP on the ZyXEL Device.
Maintenance		
System	General	This screen contains administrative and system-related information and also allows you to change your password.
	Time Setting	Use this screen to change your ZyXEL Device's time and date.
Logs	View Log	Use this screen to view the logs for the categories that you selected.
	Log Settings	Use this screen to change your ZyXEL Device's log settings.
Tools	Firmware	Use this screen to upload firmware to your ZyXEL Device.
	Configuration	Use this screen to backup and restore the configuration or reset the factory defaults to your ZyXEL Device.
	Restart	This screen allows you to reboot the ZyXEL Device without turning the power off.
Diagnostic	General	These screens display information to help you identify problems with the ZyXEL Device general connection.
	DSL Line	These screens display information to help you identify problems with the DSL line.

2.4.2 Status Screen

The following summarizes how to navigate the web configurator from the **Status** screen. Some fields or links are not available if you entered the user password in the login password screen (see Figure 8 on page 46).

Figure 12 Status Screen



The following table describes the labels shown in the **Status** screen.

Table 5 Status Screen

LABEL	DESCRIPTION
Refresh Interval	Select a number of seconds or **None** from the drop-down list box to refresh all screen statistics automatically at the end of every time interval or to not refresh the screen statistics.
Apply	Click this button to refresh the status screen statistics.
Device Information	
Host Name	This is the **System Name** you enter in the **Maintenance** > **System** > **General** screen. It is for identification purposes.
Model Number	This is your ZyXEL Device's model name.
MAC Address	This is the MAC (Media Access Control) or Ethernet address unique to your ZyXEL Device.
ZyNOS Firmware Version	This is the ZyNOS Firmware version and the date created. ZyNOS is ZyXEL's proprietary Network Operating System design.
DSL Firmware Version	This field displays the current version of the device's DSL modem code.
WAN Information	
DSL Mode	This is the standard that your ZyXEL Device is using.
IP Address	This is the WAN port IP address.
IP Subnet Mask	This is the WAN port IP subnet mask.
Default Gateway	This is the IP address of the default gateway, if applicable.
VPI/VCI	This is the Virtual Path Identifier and Virtual Channel Identifier that you entered in the wizard or **WAN** screen.
LAN Information	
IP Address	This is the LAN port IP address.

Table 5 Status Screen

LABEL	DESCRIPTION
IP Subnet Mask	This is the LAN port IP subnet mask.
DHCP	This is the WAN port DHCP role - **Server**, **Relay** or **None**.
WLAN Information	
SSID	This is the descriptive name used to identify the ZyXEL Device in the wireless LAN.
Channel	This is the channel number used by the ZyXEL Device now.
Security	This displays the WLAN security mode.
Security	
Firewall	This displays whether or not the ZyXEL Device's firewall is activated.
Content Filter	This displays whether or not the ZyXEL Device's content filtering is activated.
System Status	
System Uptime	This is the total time the ZyXEL Device has been on.
Current Date/ Time	This field displays your ZyXEL Device's present date and time.
System Mode	This displays whether the ZyXEL Device is functioning as a router or a bridge.
CPU Usage	This number shows how many kilobytes of the heap memory the ZyXEL Device is using. Heap memory refers to the memory that is not used by ZyNOS (ZyXEL Network Operating System) and is thus available for running processes like NAT, VPN and the firewall. The bar displays what percent of the ZyXEL Device's heap memory is in use. The bar turns from green to red when the maximum is being approached.
Memory Usage	This number shows the ZyXEL Device's total heap memory (in kilobytes). The bar displays what percent of the ZyXEL Device's heap memory is in use. The bar turns from green to red when the maximum is being approached.
Interface Status	
Interface	This displays the ZyXEL Device port types.
Status	This field displays **Down** (line is down), **Up** (line is up or connected) if you're using Ethernet encapsulation and **Down** (line is down), **Up** (line is up or connected), **Idle** (line (ppp) idle), **Dial** (starting to trigger a call) and **Drop** (dropping a call) if you're using PPPoE encapsulation. For the WLAN port, it displays **Active** when WLAN is enabled or **Inactive** when WLAN is disabled.
Rate	For the LAN ports, this displays the port speed and duplex setting. Ethernet port connections can be in half-duplex or full-duplex mode. Full-duplex refers to a device's ability to send and receive simultaneously, while half-duplex indicates that traffic can flow in only one direction at a time. The Ethernet port must use the same speed or duplex mode setting as the peer Ethernet port in order to connect. For the WAN port, it displays the downstream and upstream transmission rate. For the WLAN port, it displays the transmission rate when WLAN is enabled or **N/A** when WLAN is disabled.
Summary	
Any IP Table	Use this screen to view a list of IP addresses and MAC addresses of computers, which are not in the same subnet as the ZyXEL Device.
WLAN Status	This screen displays the MAC address(es) of the wireless stations that are currently associating with the ZyXEL Device.

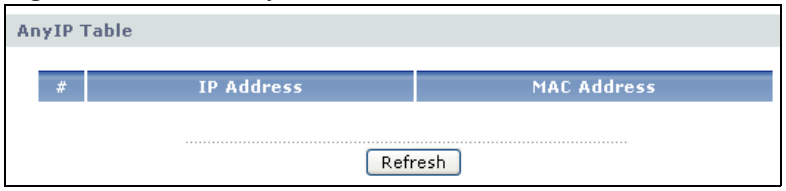
Table 5 Status Screen

LABEL	DESCRIPTION
Bandwidth Status	Use this screen to view the ZyXEL Device's bandwidth usage and allotments.
Packet Statistics	Use this screen to view port status and packet specific statistics.

2.4.3 Status: Any IP Table

Click the **Any IP Table** hyperlink in the **Status** screen. The Any IP table shows current read-only information (including the IP address and the MAC address) of all network devices that use the Any IP feature to communicate with the ZyXEL Device.

Figure 13 Status: Any IP Table



The following table describes the labels in this screen.

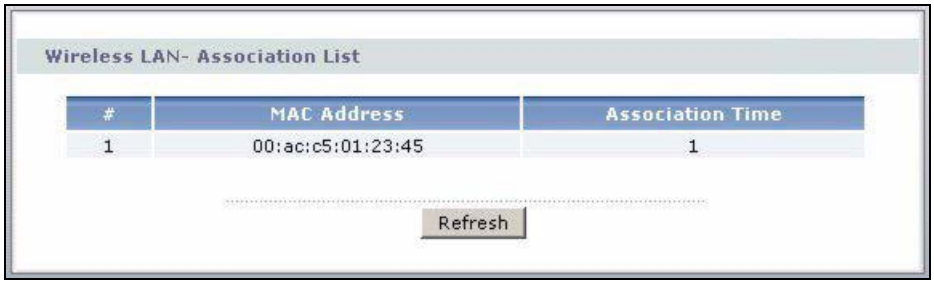
Table 6 Status: Any IP Table

LABEL	DESCRIPTION
#	This is the index number of the host computer.
IP Address	This field displays the IP address of the network device.
MAC Address	This field displays the MAC (Media Access Control) address of the computer with the displayed IP address. Every Ethernet device has a unique MAC address. The MAC address is assigned at the factory and consists of six pairs of hexadecimal characters, for example, 00:A0:C5:00:00:02.
Refresh	Click **Refresh** to update this screen.

2.4.4 Status: WLAN Status

Click the **WLAN Status** hyperlink in the **Status** screen to view the wireless stations that are currently associated to the ZyXEL Device.

Figure 14 Status: WLAN Status



The following table describes the labels in this screen.

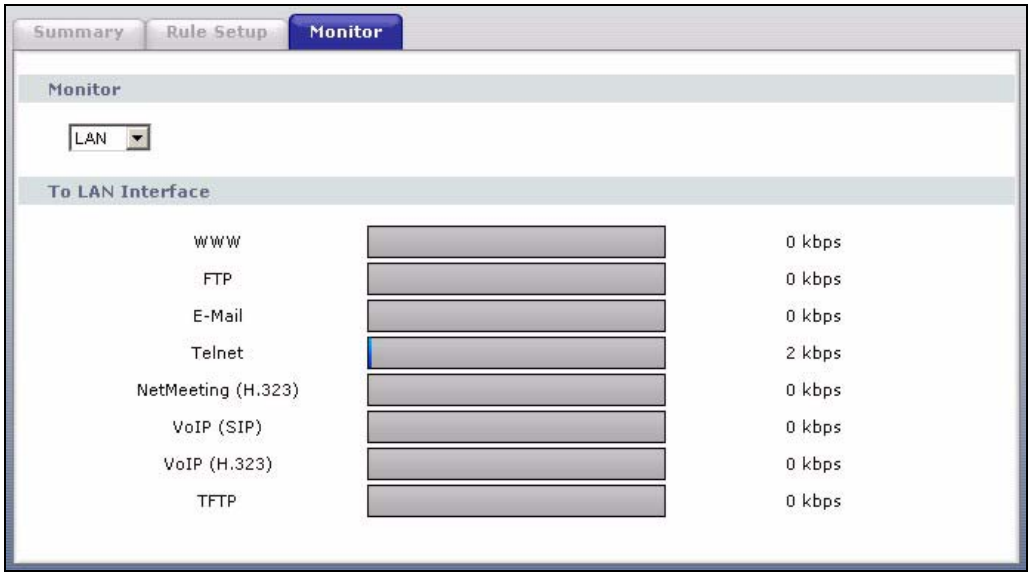
Table 7 Status: WLAN Status

LABEL	DESCRIPTION
#	This is the index number of an associated wireless station.
MAC Address	This field displays the MAC (Media Access Control) address of an associated wireless station.
Association TIme	This field displays the time a wireless station first associated with the ZyXEL Device.
Refresh	Click **Refresh** to reload this screen.

2.4.5 Status: Bandwidth Status

Click the **Bandwidth Status** hyperlink in the **Status** screen. Select an interface from the drop-down list box to view the bandwidth usage of its bandwidth rules. The gray section of the bar represents the percentage of unused bandwidth and the blue color represents the percentage of bandwidth in use.

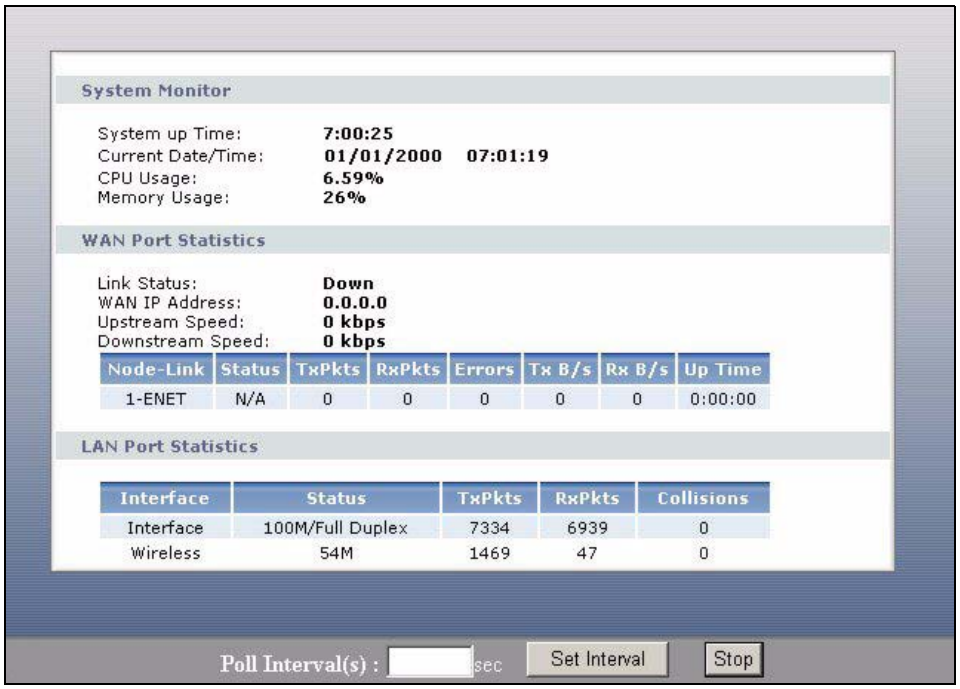
Figure 15 Status: Bandwidth Status



2.4.6 Status: Packet Statistics

Click the **Packet Statistics** hyperlink in the **Status** screen. Read-only information here includes port status and packet specific statistics. Also provided are "system up time" and "poll interval(s)". The **Poll Interval(s)** field is configurable. Not all fields are available on all models

Figure 16 Status: Packet Statistics


System Monitor
System up Time: 7:00:25
Current Date/Time: 01/01/2000 07:01:19
CPU Usage: 6.59%
Memory Usage: 26%
WAN Port Statistics
Link Status: Down
WAN IP Address: 0.0.0.0
Upstream Speed: 0 kbps
Downstream Speed: 0 kbps
Node-Link Status TxPkts RxPkts Errors Tx B/s Rx B/s Up Time
1-ENET N/A 0 0 0 0 0 0:00:00
LAN Port Statistics
Interface Status TxPkts RxPkts Collisions
Interface 100M/Full Duplex 7334 6939 0
Wireless 54M 1469 47 0
Poll Interval(s) : sec Set Interval Stop

The following table describes the fields in this screen.

Table 8 Status: Packet Statistics

LABEL	DESCRIPTION
System Monitor	
System up Time	This is the elapsed time the system has been up.
Current Date/Time	This field displays your ZyXEL Device's present date and time.
CPU Usage	This field specifies the percentage of CPU utilization.
Memory Usage	This field specifies the percentage of memory utilization.
LAN or WAN Port Statistics	This is the WAN or LAN port.
Link Status	This is the status of your WAN link.
Upstream Speed	This is the upstream speed of your ZyXEL Device.
Downstream Speed	This is the downstream speed of your ZyXEL Device.
Node-Link	This field displays the remote node index number and link type. Link types are PPPoA, ENET, RFC 1483 and PPPoE.
Interface	This field displays the type of port.
Status	This field displays **Down** (line is down), **Up** (line is up or connected) if you're using Ethernet encapsulation and **Down** (line is down), **Up** (line is up or connected), **Idle** (line (ppp) idle), **Dial** (starting to trigger a call) and **Drop** (dropping a call) if you're using PPPoE encapsulation. For the WLAN port, it displays the transmission rate when WLAN is enabled or **N/A** when WLAN is disabled.
TxPkts	This field displays the number of packets transmitted on this port.
RxPkts	This field displays the number of packets received on this port.
Errors	This field displays the number of error packets on this port.

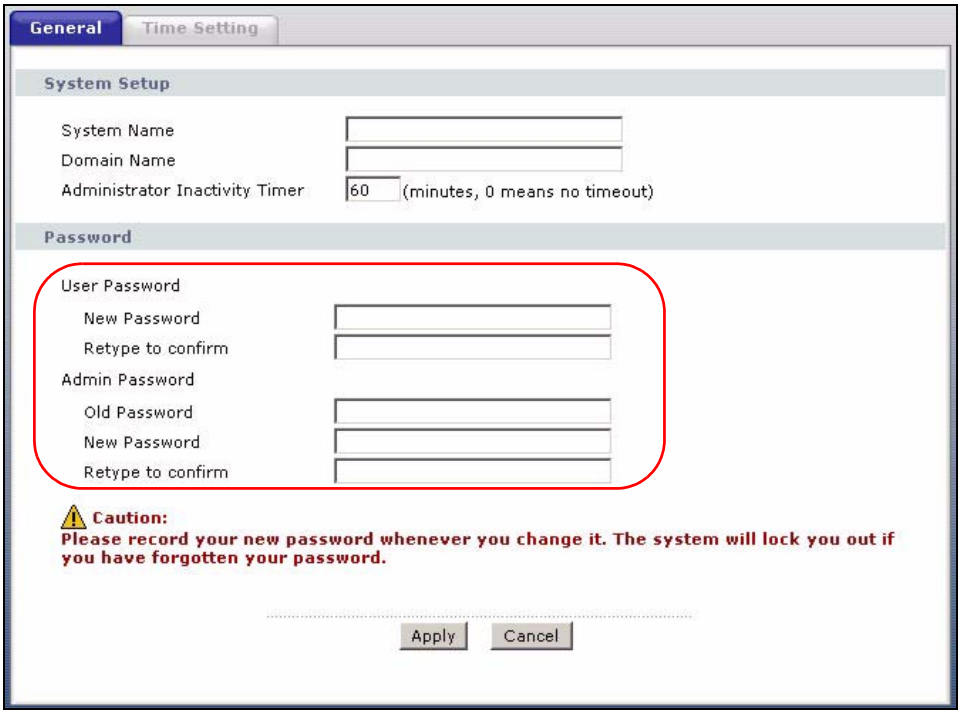
Table 8 Status: Packet Statistics (continued)

LABEL	DESCRIPTION
Tx B/s	This field displays the number of bytes transmitted in the last second.
Rx B/s	This field displays the number of bytes received in the last second.
Up Time	This field displays the elapsed time this port has been up.
Collisions	This is the number of collisions on this port.
Poll Interval(s)	Type the time interval for the browser to refresh system statistics.
Set Interval	Click this button to apply the new poll interval you entered in the **Poll Interval** field above.
Stop	Click this button to halt the refreshing of the system statistics.

2.4.7 Changing Login Password

It is highly recommended that you periodically change the password for accessing the ZyXEL Device. If you didn't change the default one after you logged in or you want to change to a new password again, then click **Maintenance > System** to display the screen shown next. See Table 97 on page 248 for detailed field descriptions.

Figure 17 System General



3

Wizard Setup for Internet Access

This chapter provides information on the Wizard Setup screens for Internet access in the web configurator.

3.1 Introduction

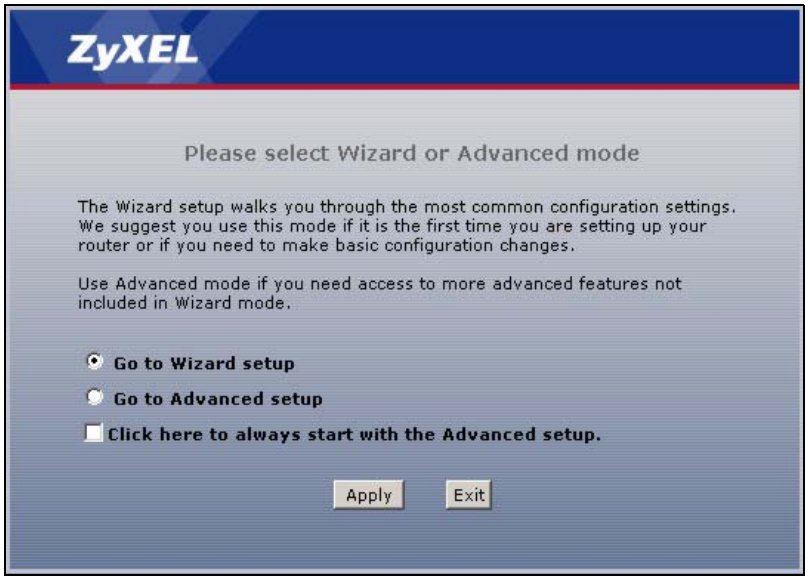
Use the wizard setup screens to configure your system for Internet access with the information given to you by your ISP.

See the advanced menu chapters for background information on these fields.

3.2 Internet Access Wizard Setup

1 After you enter the admin password to access the web configurator, select **Go to Wizard setup** and click **Apply**. Otherwise, click the wizard icon ( ) in the top right corner of the web configurator to display the wizard main screen.

Figure 18 Select a Mode


ZyXEL
Please select Wizard or Advanced mode
The Wizard setup walks you through the most common configuration settings. We suggest you use this mode if it is the first time you are setting up your router or if you need to make basic configuration changes.
Use Advanced mode if you need access to more advanced features not included in Wizard mode.
Go to Wizard setup
Go to Advanced setup
Click here to always start with the Advanced setup.
Apply
Exit

2 Click **INTERNET/WIRELESS SETUP** to configure the system for Internet access and wireless connection.

Figure 19 Wizard: Welcome

ZyXEL
Welcome to the ZyXEL Wizard Setup
INTERNET/WIRELESS SETUP
The connection wizard will walk you through the most common configuration options. This wizard has been broken down into two steps, each of which may have multiple pages.
BANDWIDTH MANAGEMENT SETUP
ZyXEL's Media Bandwidth Management allows you to allocate bandwidth based on applications/services and/or user(s). You can prioritize unused bandwidth capacity for defined services/users via 3 basic bandwidth classes, low medium and high.
Exit

3 The wizard attempts to detect which WAN connection type you are using.

If the wizard detects your connection type and your ISP uses PPPoE or PPPoA, go to Section 3.2.1 on page 59. The screen varies depending on the connection type you use.

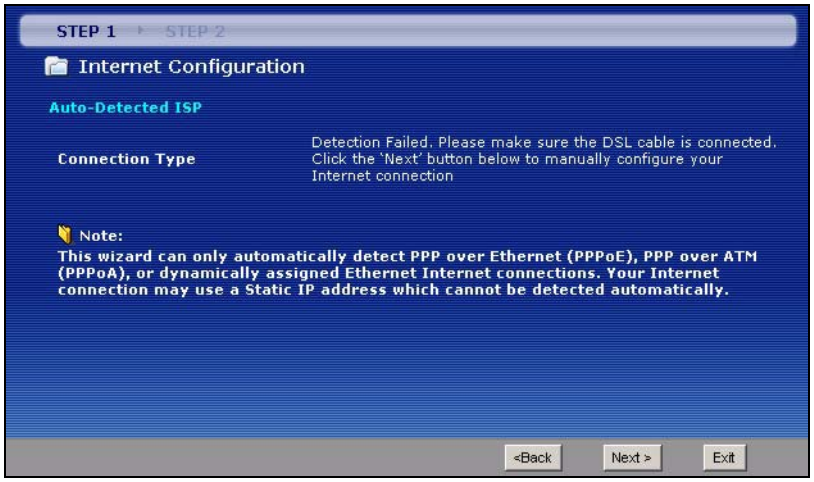
If the wizard does not detect a connection type and the following screen appears (see Figure 20 on page 58), check your hardware connections and click **Restart the Internet/ Wireless Setup Wizard** to have the ZyXEL Device detect your connection again.

Figure 20 Auto Detection: No DSL Connection

STEP 1
STEP 2
Internet Configuration
No DSL connection
Your router has not established a DSL connection to your local exchange. The DSL light on the router will blink while it is trying to connect, and stay on if it connects successfully.
Restart the Internet/Wireless Setup Wizard
Continue to Wireless Setup wizard? Yes No
Next >
Exit

If the wizard still cannot detect a connection type and the following screen appears (see Figure 21 on page 59), click **Next** and refer to Section 3.2.2 on page 59 on how to configure the ZyXEL Device for Internet access manually.

Figure 21 Auto Detection: Failed

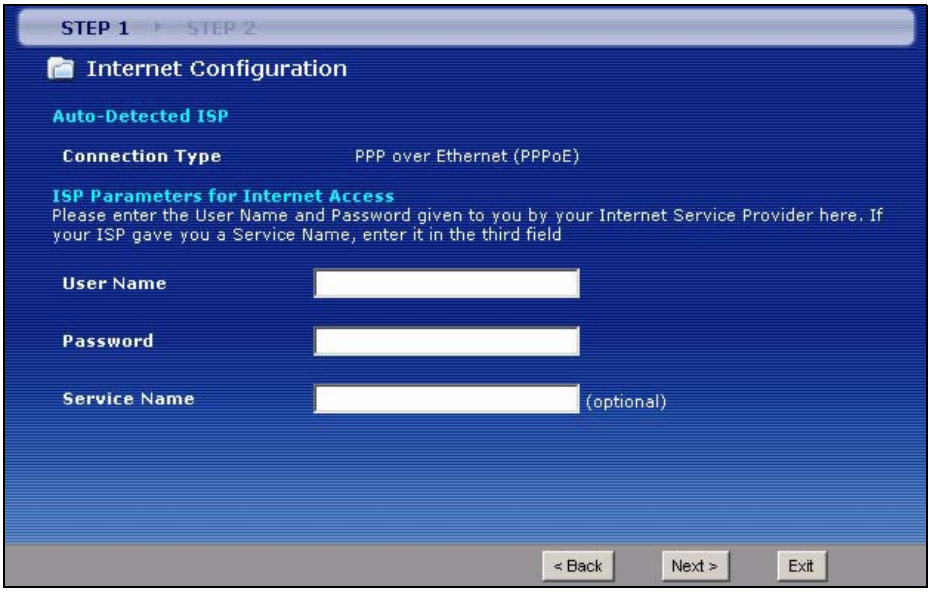

STEP 1
STEP 2
Internet Configuration
Auto-Detected ISP
Connection Type
Detection Failed. Please make sure the DSL cable is connected. Click the 'Next' button below to manually configure your Internet connection
Note:
This wizard can only automatically detect PPP over Ethernet (PPPoE), PPP over ATM (PPPoA), or dynamically assigned Ethernet Internet connections. Your Internet connection may use a Static IP address which cannot be detected automatically.
<Back
Next >
Exit

3.2.1 Automatic Detection

1 If you have a PPPoE or PPPoA connection, a screen displays prompting you to enter your Internet account information. Enter the username, password and/or service name exactly as provided.

2 Click **Next** and see Section 3.3 on page 64 for wireless connection wizard setup.

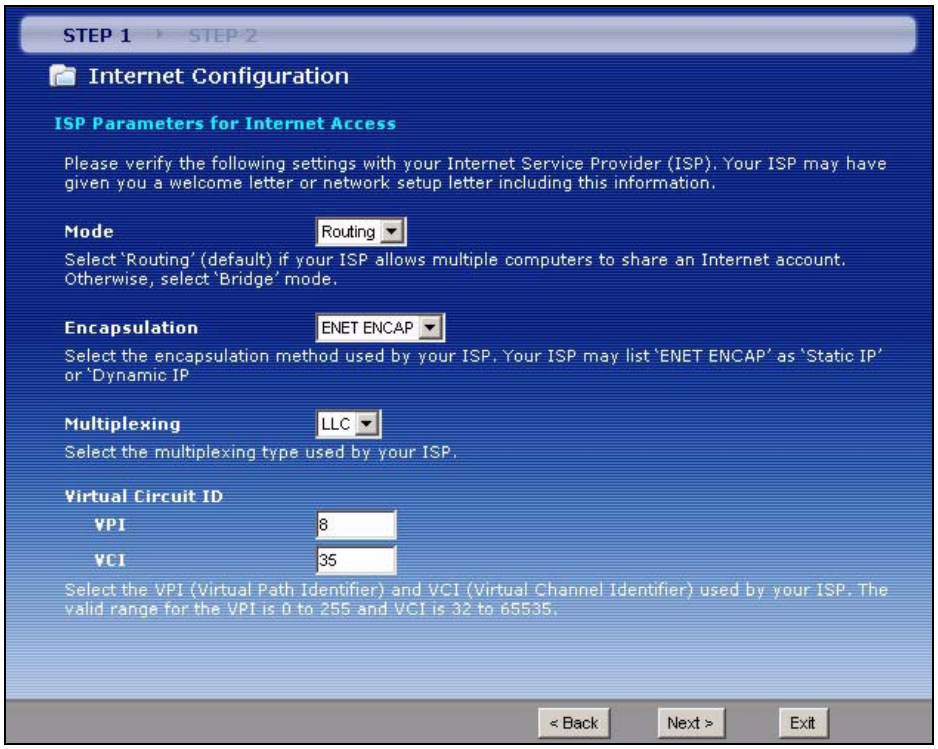
Figure 22 Auto-Detection: PPPoE


STEP 1
STEP 2
Internet Configuration
Auto-Detected ISP
Connection Type
PPP over Ethernet (PPPoE)
ISP Parameters for Internet Access
Please enter the User Name and Password given to you by your Internet Service Provider here. If your ISP gave you a Service Name, enter it in the third field
User Name
Password
Service Name
(optional)
< Back
Next >
Exit

3.2.2 Manual Configuration

1 If the ZyXEL Device fails to detect your DSL connection type, enter the Internet access information given to you by your ISP exactly in the wizard screen. If not given, leave the fields set to the default.

Figure 23 Internet Access Wizard Setup: ISP Parameters


STEP 1
STEP 2
Internet Configuration
ISP Parameters for Internet Access
Please verify the following settings with your Internet Service Provider (ISP). Your ISP may have given you a welcome letter or network setup letter including this information.
Mode
Routing
Select 'Routing' (default) if your ISP allows multiple computers to share an Internet account. Otherwise, select 'Bridge' mode.
Encapsulation
ENET ENCAP
Select the encapsulation method used by your ISP. Your ISP may list 'ENET ENCAP' as 'Static IP' or 'Dynamic IP
Multiplexing
LLC
Select the multiplexing type used by your ISP.
Virtual Circuit ID
VPI
8
VCI
35
Select the VPI (Virtual Path Identifier) and VCI (Virtual Channel Identifier) used by your ISP. The valid range for the VPI is 0 to 255 and VCI is 32 to 65535.
< Back
Next >
Exit

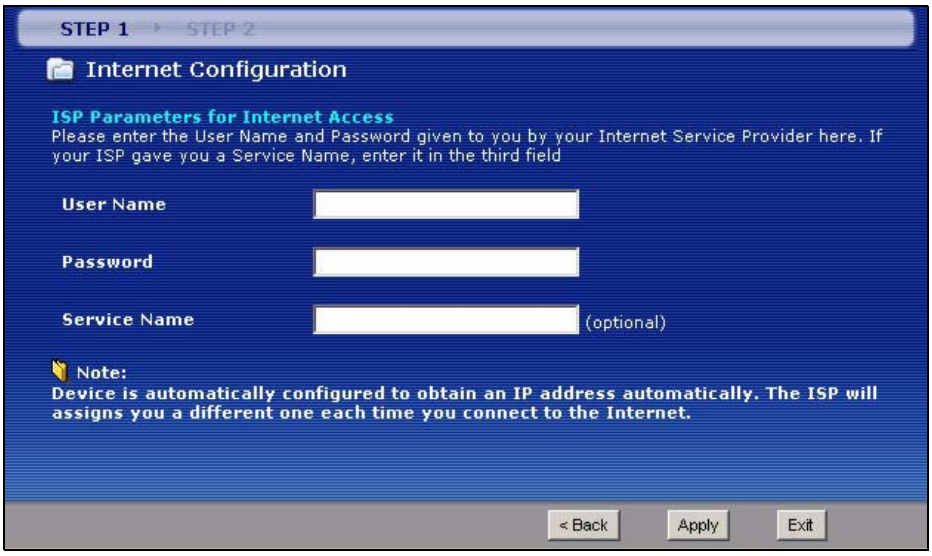
The following table describes the fields in this screen.

Table 9 Internet Access Wizard Setup: ISP Parameters

LABEL	DESCRIPTION
Mode	From the **Mode** drop-down list box, select **Routing** (default) if your ISP allows multiple computers to share an Internet account. Otherwise select **Bridge**.
Encapsulation	Select the encapsulation type your ISP uses from the **Encapsulation** drop-down list box. Choices vary depending on what you select in the **Mode** field. If you select **Bridge** in the **Mode** field, select either **PPPoA** or **RFC 1483**. If you select **Routing** in the **Mode** field, select **PPPoA**, **RFC 1483**, **ENET ENCAP** or **PPPoE**.
Multiplexing	Select the multiplexing method used by your ISP from the **Multiplex** drop-down list box either VC-based or LLC-based.
Virtual Circuit ID	VPI (Virtual Path Identifier) and VCI (Virtual Channel Identifier) define a virtual circuit. Refer to the appendix for more information.
VPI	Enter the VPI assigned to you. This field may already be configured.
VCI	Enter the VCI assigned to you. This field may already be configured.
Back	Click **Back** to go back to the previous screen.
Next	Click **Next** to continue to the next wizard screen. The next wizard screen you see depends on what protocol you chose above.
Exit	Click **Exit** to close the wizard screen without saving your changes.

2 The next wizard screen varies depending on what mode and encapsulation type you use. All screens shown are with routing mode. Configure the fields and click **Next** to continue. See Section 3.3 on page 64 for wireless connection wizard setup

Figure 24 Internet Connection with PPPoE

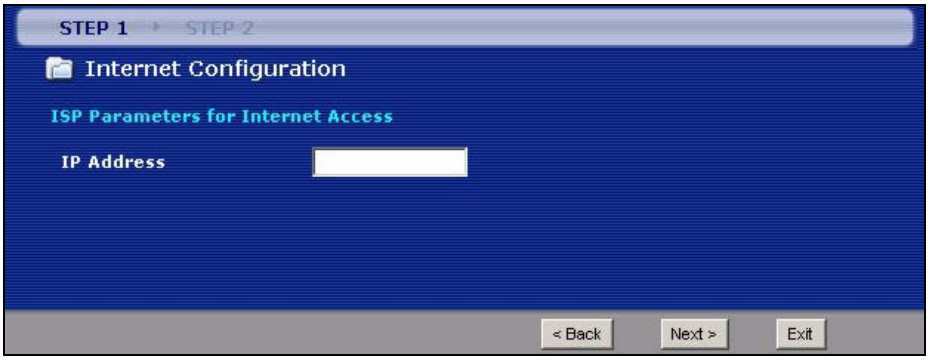

STEP 1
STEP 2
Internet Configuration
ISP Parameters for Internet Access
Please enter the User Name and Password given to you by your Internet Service Provider here. If your ISP gave you a Service Name, enter it in the third field
User Name
Password
Service Name
(optional)
Note:
Device is automatically configured to obtain an IP address automatically. The ISP will assigns you a different one each time you connect to the Internet.
< Back
Apply
Exit

The following table describes the fields in this screen.

Table 10 Internet Connection with PPPoE

LABEL	DESCRIPTION
User Name	Enter the user name exactly as your ISP assigned. If assigned a name in the form user@domain where domain identifies a service name, then enter both components exactly as given.
Password	Enter the password associated with the user name above.
Service Name	Type the name of your PPPoE service here.
Back	Click **Back** to go back to the previous wizard screen.
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Exit	Click **Exit** to close the wizard screen without saving your changes.

Figure 25 Internet Connection with RFC 1483



The following table describes the fields in this screen.

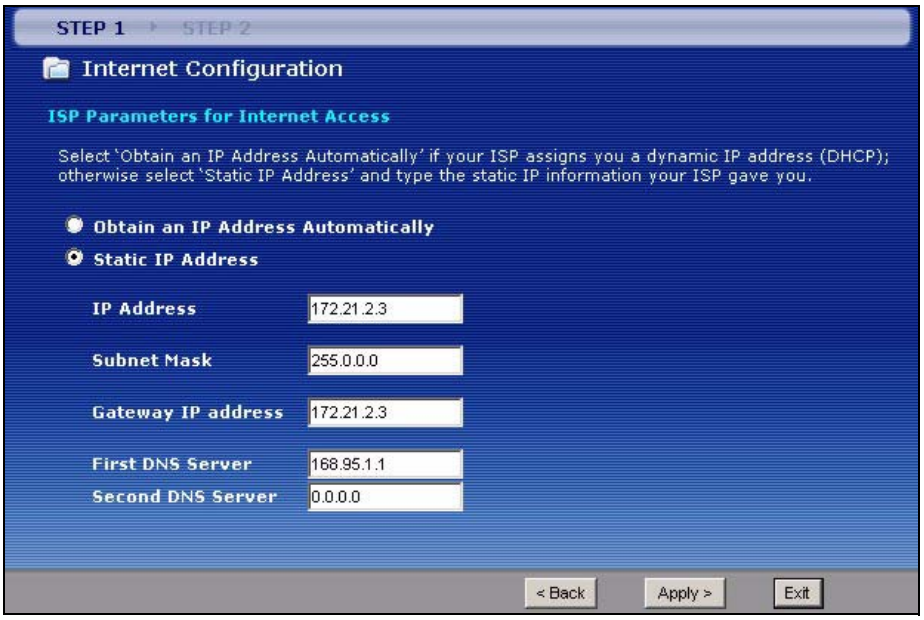
Table 11 Internet Connection with RFC 1483

LABEL	DESCRIPTION
IP Address	This field is available if you select **Routing** in the **Mode** field. Type your ISP assigned IP address in this field.
Back	Click **Back** to go back to the previous wizard screen.

Table 11 Internet Connection with RFC 1483 (continued)

LABEL	DESCRIPTION
Next	Click **Next** to continue to the next wizard screen.
Exit	Click **Exit** to close the wizard screen without saving your changes.

Figure 26 Internet Connection with ENET ENCAP



The following table describes the fields in this screen.

Table 12 Internet Connection with ENET ENCAP

LABEL	DESCRIPTION
Obtain an IP Address Automatically	A static IP address is a fixed IP that your ISP gives you. A dynamic IP address is not fixed; the ISP assigns you a different one each time you connect to the Internet. Select **Obtain an IP Address Automatically** if you have a dynamic IP address.
Static IP Address	Select **Static IP Address** if your ISP gives you a fixed IP address.
IP Address	Enter your ISP assigned IP address.
Subnet Mask	Enter a subnet mask in dotted decimal notation. Refer to the appendices to calculate a subnet mask If you are implementing subnetting.
Gateway IP address	You must specify a gateway IP address (supplied by your ISP) when you use **ENET ENCAP** in the **Encapsulation** field in the previous screen.
First DNS Server	Enter the IP addresses of the DNS servers. The DNS servers are passed to the DHCP clients along with the IP address and the subnet mask.
Second DNS Server	As above.
Back	Click **Back** to go back to the previous wizard screen.
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Exit	Click **Exit** to close the wizard screen without saving your changes.

Figure 27 Internet Connection with PPPoA

STEP 1
STEP 2
Internet Configuration
ISP Parameters for Internet Access
Please enter the User Name and Password given to you by your Internet Service Provider here
User Name
Password
Note:
Device is automatically configured to obtain an IP address automatically. The ISP will assigns you a different one each time you connect to the Internet.
< Back
Apply
Exit

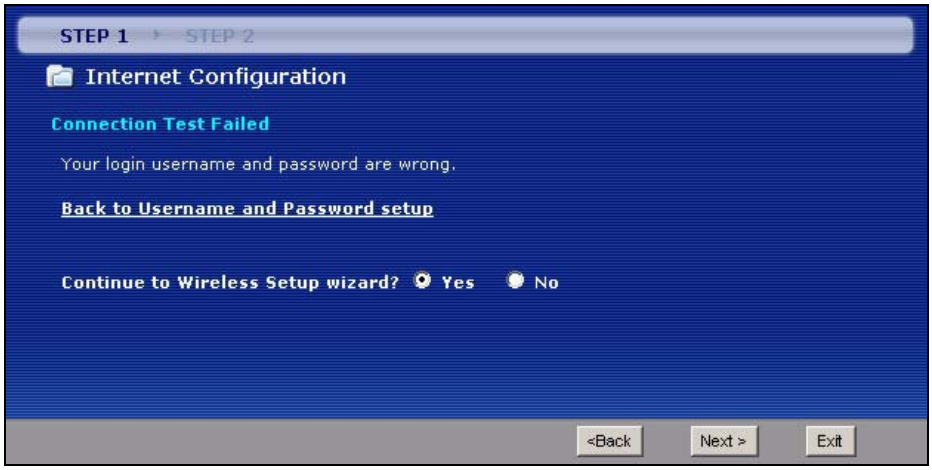
The following table describes the fields in this screen.

Table 13 Internet Connection with PPPoA

LABEL	DESCRIPTION
User Name	Enter the login name that your ISP gives you.
Password	Enter the password associated with the user name above.
Back	Click **Back** to go back to the previous wizard screen.
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Exit	Click **Exit** to close the wizard screen without saving your changes.

- If the user name and/or password you entered for PPPoE or PPPoA connection are not correct, the screen displays as shown next. Click **Back to Username and Password setup** to go back to the screen where you can modify them.

Figure 28 Connection Test Failed-1



- If the following screen displays, check if your account is activated or click **Restart the Internet/Wireless Setup Wizard** to verify your Internet access settings.

Figure 29 Connection Test Failed-2.

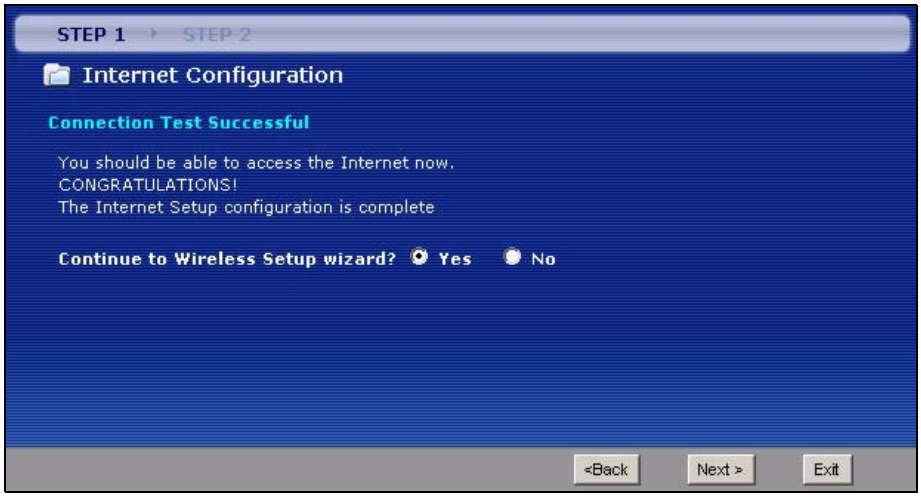
STEP 1
STEP 2
Internet Configuration
Connection Test Failed
Cannot access the Internet, please check your ISP account is active and that the settings you entered in the wizard are correct. If you still have problems, please contact customer support.
Restart the Internet/Wireless Setup Wizard
Continue to Wireless Setup wizard? Yes No
<Back
Next >
Exit

3.3 Wireless Connection Wizard Setup

After you configure the Internet access information, use the following screens to set up your wireless LAN.

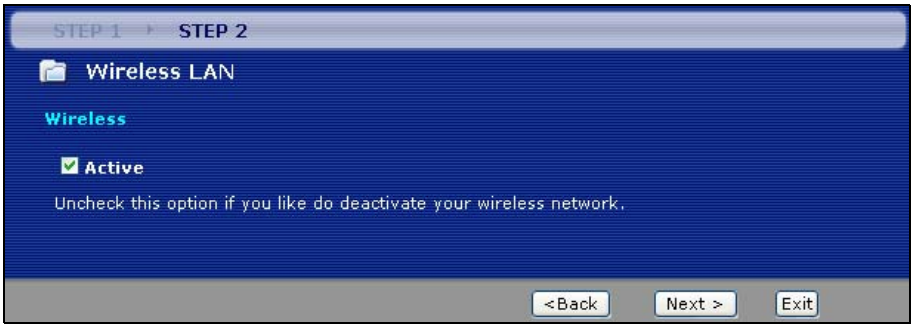
1 Select **Yes** and click **Next** to configure wireless settings. Otherwise, select **No** and skip to Step 6.

Figure 30 Connection Test Successful



2 Use this screen to activate the wireless LAN and OTIST. Click **Next** to continue.

Figure 31 Wireless LAN Setup Wizard 1



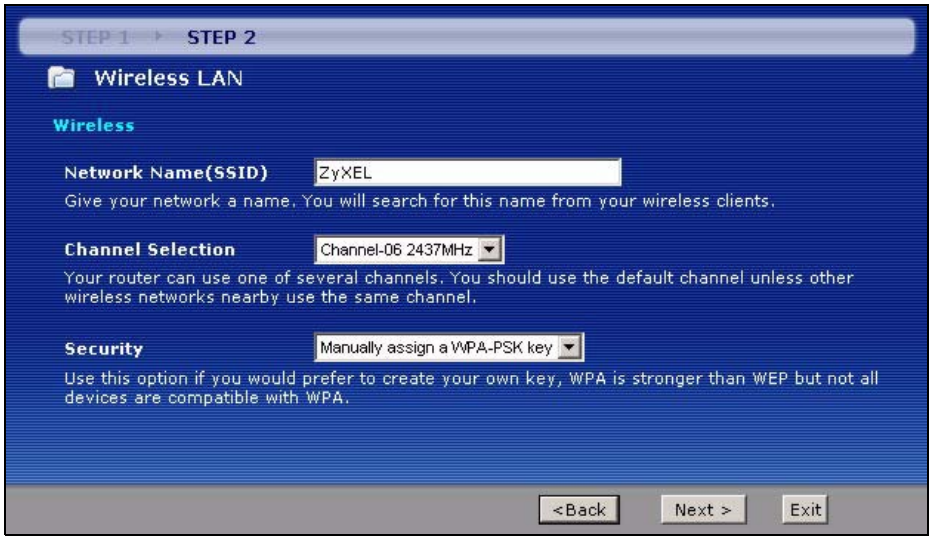
The following table describes the labels in this screen.

Table 14 Wireless LAN Setup Wizard 1

LABEL	DESCRIPTION
Active	Select the check box to turn on the wireless LAN.
Back	Click **Back** to display the previous screen.
Next	Click **Next** to proceed to the next screen.
Exit	Click **Exit** to close the wizard screen without saving.

3 Configure your wireless settings in this screen. Click **Next**.

Figure 32 Wireless LAN Setup Wizard 2


STEP 1
STEP 2
Wireless LAN
Wireless
Network Name(SSID)
ZyXEL
Give your network a name. You will search for this name from your wireless clients.
Channel Selection
Channel-06 2437MHz
Your router can use one of several channels. You should use the default channel unless other wireless networks nearby use the same channel.
Security
Manually assign a WPA-PSK key
Use this option if you would prefer to create your own key, WPA is stronger than WEP but not all devices are compatible with WPA.
<Back
Next >
Exit

The following table describes the labels in this screen.

Table 15 Wireless LAN Setup Wizard 2

LABEL	DESCRIPTION
Network Name(SSID)	Enter a descriptive name (up to 32 printable 7-bit ASCII characters) for the wireless LAN. If you change this field on the ZyXEL Device, make sure all wireless stations use the same SSID in order to access the network.
Channel Selection	The range of radio frequencies used by IEEE 802.11b/g wireless devices is called a channel. Select a channel ID that is not already in use by a neighboring device.

Table 15 Wireless LAN Setup Wizard 2

LABEL	DESCRIPTION
Security	Select **Manually assign a WPA-PSK key** to configure a pre-shared key (WPA-PSK). Choose this option only if your wireless clients support WPA. See Section 3.3.1 on page 66 for more information. Select **Manually assign a WEP key** to configure a WEP Key. See Section 3.3.2 on page 67 for more information. Select **Disable wireless security** to have no wireless LAN security configured and your network is accessible to any wireless networking device that is within range.
Back	Click **Back** to display the previous screen.
Next	Click **Next** to proceed to the next screen.
Exit	Click **Exit** to close the wizard screen without saving.

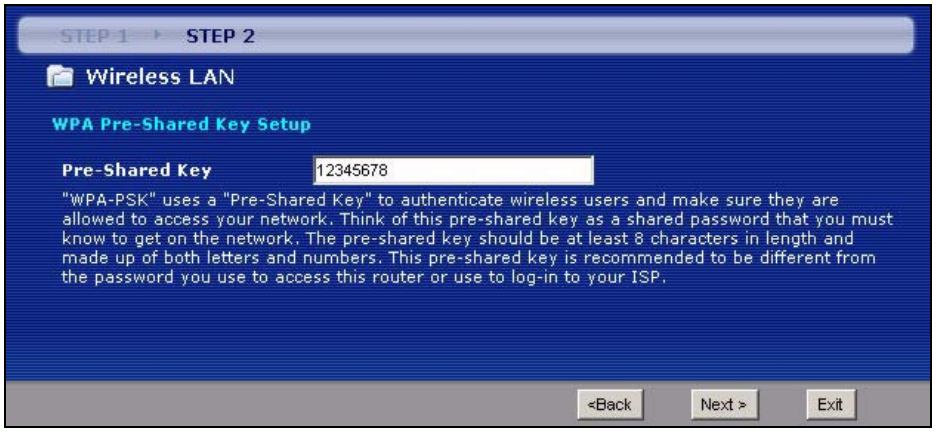
The wireless stations and ZyXEL Device must use the same SSID, channel ID and WEP encryption key (if WEP is enabled), WPA-PSK (if WPA-PSK is enabled) for wireless communication.

4 This screen varies depending on the security mode you selected in the previous screen. Fill in the field (if available) and click **Next**.

3.3.1 Manually assign a WPA-PSK key

Choose **Manually assign a WPA-PSK key** in the Wireless LAN setup screen to set up a **Pre-Shared Key**.

Figure 33 Manually assign a WPA-PSK key


STEP 1
STEP 2
Wireless LAN
WPA Pre-Shared Key Setup
Pre-Shared Key
12345678
"WPA-PSK" uses a "Pre-Shared Key" to authenticate wireless users and make sure they are allowed to access your network. Think of this pre-shared key as a shared password that you must know to get on the network. The pre-shared key should be at least 8 characters in length and made up of both letters and numbers. This pre-shared key is recommended to be different from the password you use to access this router or use to log-in to your ISP.
<Back
Next >
Exit

The following table describes the labels in this screen.

Table 16 Manually assign a WPA key

LABEL	DESCRIPTION
Pre-Shared Key	Type from 8 to 63 case-sensitive ASCII characters. You can set up the most secure wireless connection by configuring WPA in the wireless LAN screens. You need to configure an authentication server to do this.
Back	Click **Back** to display the previous screen.

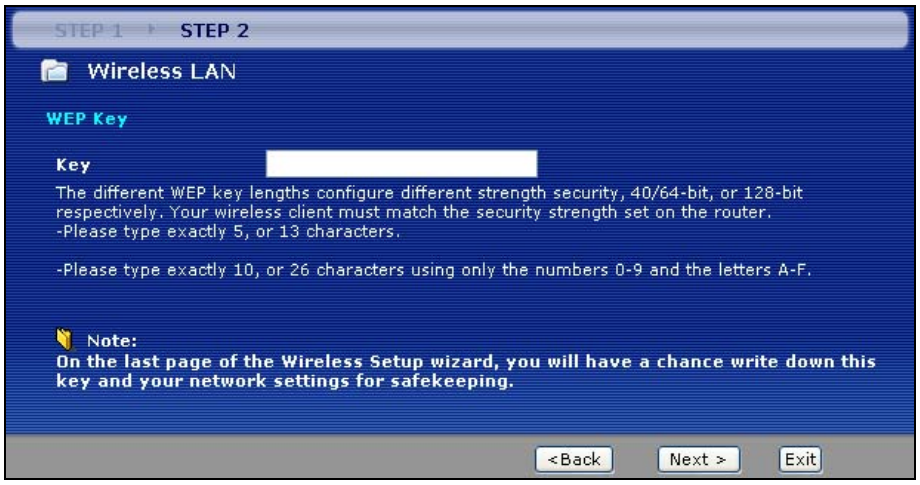
Table 16 Manually assign a WPA key

LABEL	DESCRIPTION
Next	Click **Next** to proceed to the next screen.
Exit	Click **Exit** to close the wizard screen without saving.

3.3.2 Manually assign a WEP key

Choose **Manually assign a WEP key** to setup WEP Encryption parameters.

Figure 34 Manually assign a WEP key


STEP 1
STEP 2
Wireless LAN
WEP Key
Key
The different WEP key lengths configure different strength security, 40/64-bit, or 128-bit respectively. Your wireless client must match the security strength set on the router.
-Please type exactly 5, or 13 characters.
-Please type exactly 10, or 26 characters using only the numbers 0-9 and the letters A-F.
Note:
On the last page of the Wireless Setup wizard, you will have a chance write down this key and your network settings for safekeeping.
<Back
Next >
Exit

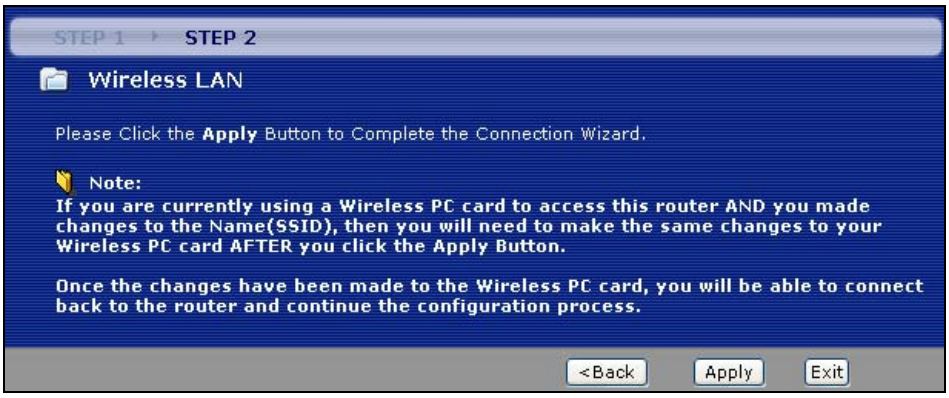
The following table describes the labels in this screen.

Table 17 Manually assign a WEP key

LABEL	DESCRIPTION
Key	The WEP keys are used to encrypt data. Both the ZyXEL Device and the wireless stations must use the same WEP key for data transmission. Enter any 5 or 13 ASCII characters or 10 or 26 hexadecimal characters ("0-9", "A-F") for a 64-bit or 128-bit WEP key respectively.
Back	Click **Back** to display the previous screen.
Next	Click **Next** to proceed to the next screen.
Exit	Click **Exit** to close the wizard screen without saving.

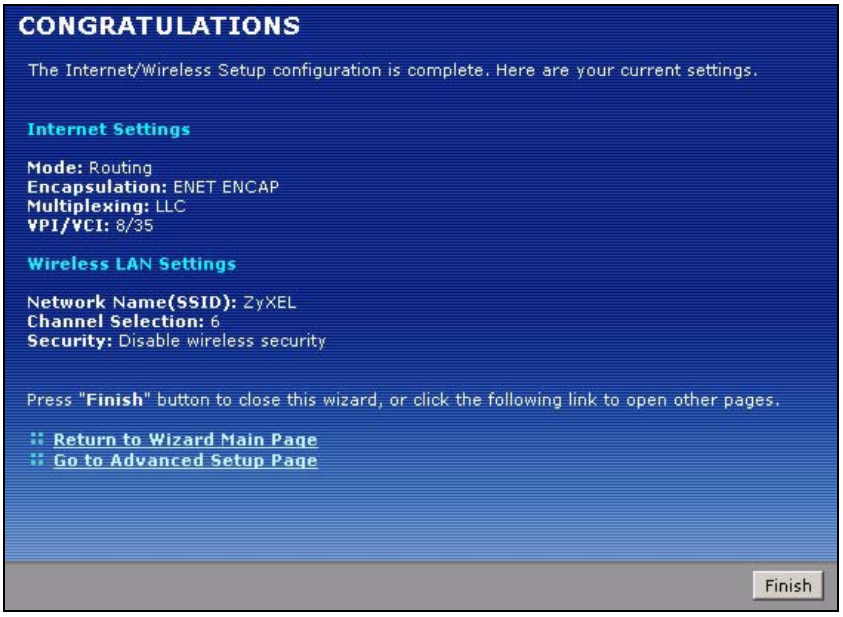
5 Click **Apply** to save your wireless LAN settings.

Figure 35 Wireless LAN Setup 3


STEP 1
STEP 2
Wireless LAN
Please Click the Apply Button to Complete the Connection Wizard.
Note:
If you are currently using a Wireless PC card to access this router AND you made changes to the Name(SSID), then you will need to make the same changes to your Wireless PC card AFTER you click the Apply Button.
Once the changes have been made to the Wireless PC card, you will be able to connect back to the router and continue the configuration process.
<Back
Apply
Exit

6 Use the read-only summary table to check whether what you have configured is correct. Click **Finish** to complete and save the wizard setup.

Figure 36 Internet Access and WLAN Wizard Setup Complete


CONGRATULATIONS
The Internet/Wireless Setup configuration is complete. Here are your current settings.
Internet Settings
Mode: Routing
Encapsulation: ENET ENCAP
Multiplexing: LLC
VPI/VCI: 8/35
Wireless LAN Settings
Network Name(SSID): ZyXEL
Channel Selection: 6
Security: Disable wireless security
Press "Finish" button to close this wizard, or click the following link to open other pages.
Return to Wizard Main Page
Go to Advanced Setup Page
Finish

7 Launch your web browser and navigate to www.zyxel.com. Internet access is just the beginning. Refer to the rest of this guide for more detailed information on the complete range of ZyXEL Device features. If you cannot access the Internet, open the web configurator again to confirm that the Internet settings you configured in the wizard setup are correct.

4

Bandwidth Management Wizard

This chapter shows you how to configure basic bandwidth management using the wizard screens.

4.1 Introduction

Bandwidth management allows you to control the amount of bandwidth going out through the ZyXEL Device's WAN port and prioritize the distribution of the bandwidth according to service bandwidth requirements. This helps keep one service from using all of the available bandwidth and shutting out other users.

4.2 Predefined Media Bandwidth Management Services

The following is a description of the services that you can select and to which you can apply media bandwidth management using the wizard screens.

Table 18 Media Bandwidth Management Setup: Services

SERVICE	DESCRIPTION
E-Mail	Electronic mail consists of messages sent through a computer network to specific groups or individuals. Here are some default ports for e-mail: POP3 - port 110 IMAP - port 143 SMTP - port 25 HTTP - port 80
FTP	File Transfer Protocol enables fast transfer of files, including large files that may not be possible by e-mail. FTP uses port number 21.
NetMeeting (H.323)	A multimedia communications product from Microsoft that enables groups to teleconference and videoconference over the Internet. NetMeeting supports VoIP, text chat sessions, a whiteboard, file transfers and application sharing. NetMeeting uses H.323. H.323 is a standard teleconferencing protocol suite that provides audio, data and video conferencing. It allows for real-time point-to-point and multipoint communication between client computers over a packet-based network that does not provide a guaranteed quality of service. H.323 is transported primarily over TCP, using the default port number 1720.
VoIP (H.323)	Sending voice signals over the Internet is called Voice over IP or VoIP. H.323 is a standard teleconferencing protocol suite that provides audio, data and video conferencing. It allows for real-time point-to-point and multipoint communication between client computers over a packet-based network that does not provide a guaranteed quality of service. H.323 is transported primarily over TCP, using the default port number 1720.

Table 18 Media Bandwidth Management Setup: Services (continued)

SERVICE	DESCRIPTION
VoIP (SIP)	Sending voice signals over the Internet is called Voice over IP or VoIP. Session Initiated Protocol (SIP) is an internationally recognized standard for implementing VoIP. SIP is an application-layer control (signaling) protocol that handles the setting up, altering and tearing down of voice and multimedia sessions over the Internet. SIP is transported primarily over UDP but can also be transported over TCP, using the default port number 5060.
Telnet	Telnet is the login and terminal emulation protocol common on the Internet and in UNIX environments. It operates over TCP/IP networks. Its primary function is to allow users to log into remote host systems. Telnet uses TCP port 23.
TFTP	Trivial File Transfer Protocol is an Internet file transfer protocol similar to FTP, but uses the UDP (User Datagram Protocol) rather than TCP (Transmission Control Protocol).
WWW	The World Wide Web (WWW) is an Internet system to distribute graphical, hyper-linked information, based on Hyper Text Transfer Protocol (HTTP) - a client/server protocol for the World Wide Web. The Web is not synonymous with the Internet; rather, it is just one service on the Internet. Other services on the Internet include Internet Relay Chat and Newsgroups. The Web is accessed through use of a browser.
XBOX Live	This is Microsoft's online gaming service that lets you play multiplayer Xbox games on the Internet via broadband technology. Xbox Live uses port 3074.
eMule	This program uses advanced file sharing applications relying on central servers to search for files. eMule uses default port 4662.

4.3 Bandwidth Management Wizard Setup

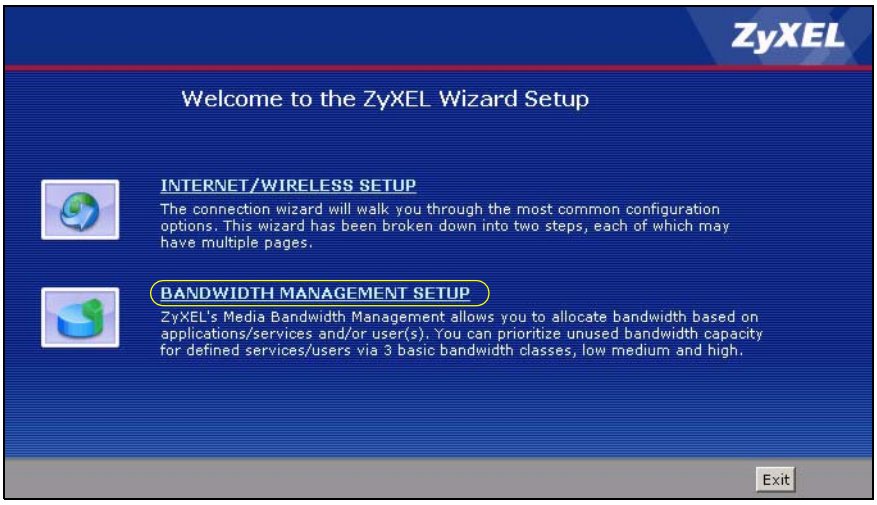
1 After you enter the admin password to access the web configurator, select **Go to Wizard setup** and click **Apply**. Otherwise, click the wizard icon ( ) in the top right corner of the web configurator to display the wizard main screen.

Figure 37 Select a Mode

ZyXEL
Please select Wizard or Advanced mode
The Wizard setup walks you through the most common configuration settings. We suggest you use this mode if it is the first time you are setting up your router or if you need to make basic configuration changes.
Use Advanced mode if you need access to more advanced features not included in Wizard mode.
Go to Wizard setup
Go to Advanced setup
Click here to always start with the Advanced setup.
Apply
Exit

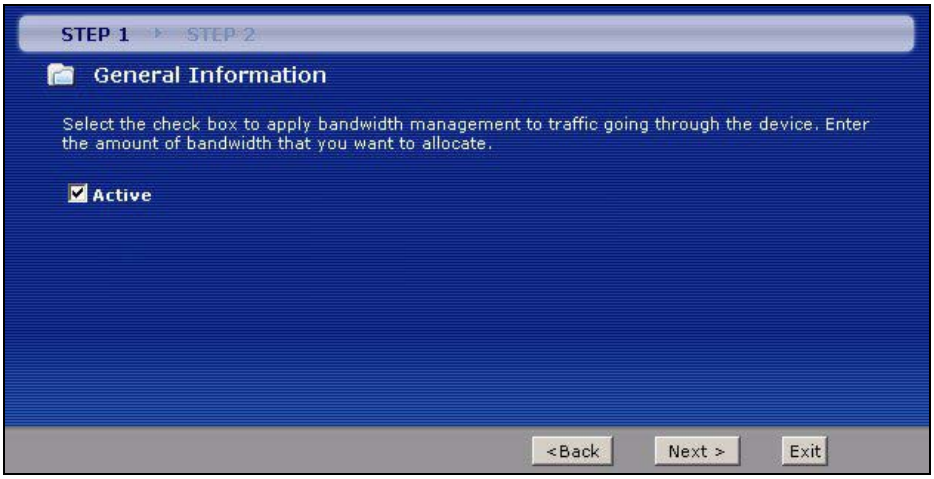
2 Click **BANDWIDTH MANAGEMENT SETUP** to configure the system for Internet access and wireless connection.

Figure 38 Wizard: Welcome


ZyXEL
Welcome to the ZyXEL Wizard Setup
INTERNET/WIRELESS SETUP
The connection wizard will walk you through the most common configuration options. This wizard has been broken down into two steps, each of which may have multiple pages.
BANDWIDTH MANAGEMENT SETUP
ZyXEL's Media Bandwidth Management allows you to allocate bandwidth based on applications/services and/or user(s). You can prioritize unused bandwidth capacity for defined services/users via 3 basic bandwidth classes, low medium and high.
Exit

3 Activate bandwidth management and select to allocate bandwidth to packets based on the service requirements.

Figure 39 Bandwidth Management Wizard: General Information


STEP 1
STEP 2
General Information
Select the check box to apply bandwidth management to traffic going through the device. Enter the amount of bandwidth that you want to allocate.
Active
<Back
Next >
Exit

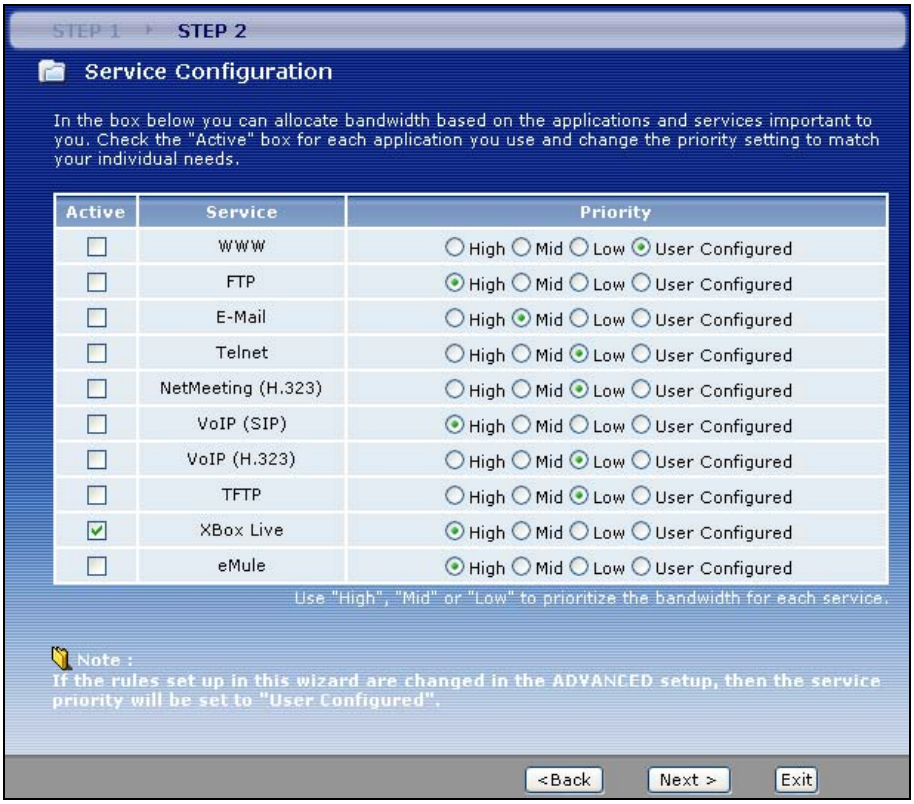
The following fields describe the label in this screen.

Table 19 Bandwidth Management Wizard: General Information

LABEL	DESCRIPTION
Active	Select the **Active** check box to have the ZyXEL Device apply bandwidth management to traffic going out through the ZyXEL Device's port(s). Select **Services Setup** to allocate bandwidth based on the service requirements.
Back	Click **Back** to display the previous screen.
Next	Click **Next** to proceed to the next screen.
Exit	Click **Exit** to close the wizard screen without saving.

4 Use the second wizard screen to select the services that you want to apply bandwidth management and select the priorities that you want to apply to the services listed.

Figure 40 Bandwidth Management Wizard: Configuration


STEP 1
STEP 2
Service Configuration
In the box below you can allocate bandwidth based on the applications and services important to you. Check the "Active" box for each application you use and change the priority setting to match your individual needs.
Active
Service
Priority
WWW
FTP
E-Mail
Telnet
NetMeeting (H.323)
VoIP (SIP)
VoIP (H.323)
TFTP
XBox Live
eMule
High Mid Low User Configured
Use "High", "Mid" or "Low" to prioritize the bandwidth for each service.
Note :
If the rules set up in this wizard are changed in the ADVANCED setup, then the service priority will be set to "User Configured".
<Back
Next >
Exit

The following table describes the labels in this screen.

Table 20 Bandwidth Management Wizard: Configuration

LABEL	DESCRIPTION
Active	Select an entry's **Active** check box to turn on bandwidth management for the service/ application.
Service	These fields display the services names.
Priority	Select **High**, **Mid** or **Low** priority for each service to have your ZyXEL Device use a priority for traffic that matches that service. A service with **High** priority is given as much bandwidth as it needs. If you select services as having the same priority, then bandwidth is divided equally amongst those services. Services not specified in bandwidth management are allocated bandwidth after all specified services receive their bandwidth requirements. If the rules set up in this wizard are changed in **Advanced** > **Bandwidth MGMT** > **Rule Setup**, then the service priority radio button will be set to **User Configured**. The **Advanced** > **Bandwidth MGMT** > **Rule Setup** screen allows you to edit these rule configurations.
Auto classifier rest bandwidth	Select **Auto classifier rest bandwidth** to automatically allocate unbudgeted or unused bandwidth to services based on the packet type.
Back	Click **Back** to go back to the previous wizard screen.
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Exit	Click **Exit** to close the wizard screen without saving your changes.

5 Follow the on-screen instructions and click **Finish** to complete the wizard setup and save your configuration.

Figure 41 Bandwidth Management Wizard: Complete

CONGRATULATIONS!
You have completed the Media Bandwidth Management setup. You can press "Finish" button to complete Bandwidth Management Setup.
Press "Finish" button to close this wizard, or click the following link to open other pages.
Return to Wizard Main Page
Go to Advanced Setup page
<Back
Finish

PART II
Wizard

Wizard Setup for Internet Access (77)
Bandwidth Management Wizard (89)

5

Wizard Setup for Internet Access

This chapter provides information on the Wizard Setup screens for Internet access in the web configurator.

5.1 Introduction

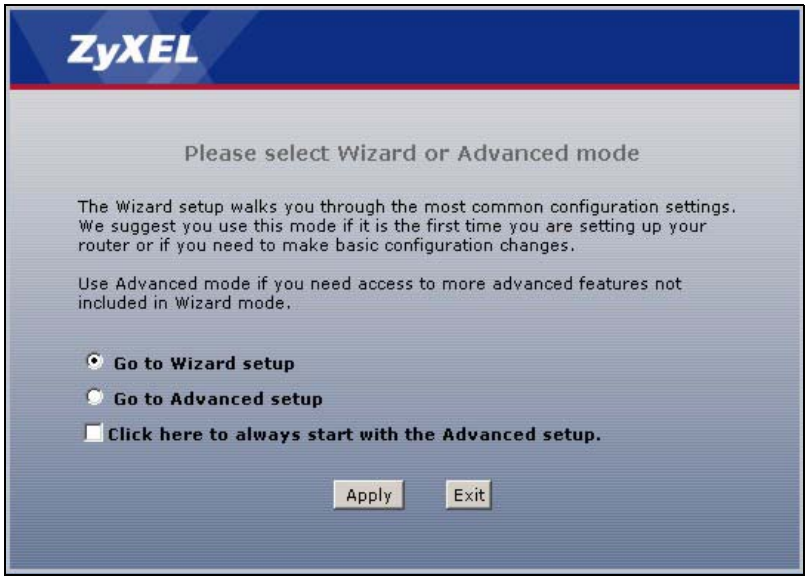
Use the wizard setup screens to configure your system for Internet access with the information given to you by your ISP.

See the advanced menu chapters for background information on these fields.

5.2 Internet Access Wizard Setup

1 After you enter the admin password to access the web configurator, select **Go to Wizard setup** and click **Apply**. Otherwise, click the wizard icon ( ) in the top right corner of the web configurator to display the wizard main screen.

Figure 42 Select a Mode


ZyXEL
Please select Wizard or Advanced mode
The Wizard setup walks you through the most common configuration settings. We suggest you use this mode if it is the first time you are setting up your router or if you need to make basic configuration changes.
Use Advanced mode if you need access to more advanced features not included in Wizard mode.
Go to Wizard setup
Go to Advanced setup
Click here to always start with the Advanced setup.
Apply
Exit

2 Click **INTERNET/WIRELESS SETUP** to configure the system for Internet access and wireless connection.

Figure 43 Wizard: Welcome

ZyXEL
Welcome to the ZyXEL Wizard Setup
INTERNET/WIRELESS SETUP
The connection wizard will walk you through the most common configuration options. This wizard has been broken down into two steps, each of which may have multiple pages.
BANDWIDTH MANAGEMENT SETUP
ZyXEL's Media Bandwidth Management allows you to allocate bandwidth based on applications/services and/or user(s). You can prioritize unused bandwidth capacity for defined services/users via 3 basic bandwidth classes, low medium and high.
Exit

3 The wizard attempts to detect which WAN connection type you are using.

If the wizard detects your connection type and your ISP uses PPPoE or PPPoA, go to Section 5.2.1 on page 79. The screen varies depending on the connection type you use.

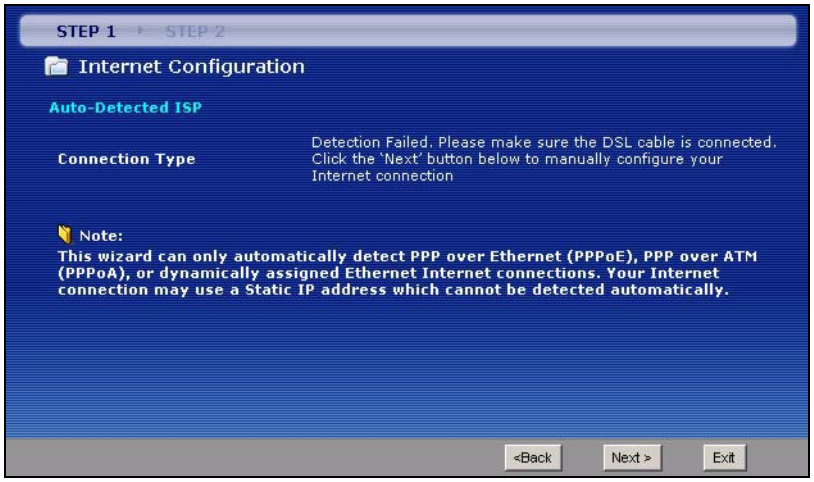
If the wizard does not detect a connection type and the following screen appears (see Figure 44 on page 78), check your hardware connections and click **Restart the Internet/ Wireless Setup Wizard** to have the ZyXEL Device detect your connection again.

Figure 44 Auto Detection: No DSL Connection

STEP 1
STEP 2
Internet Configuration
No DSL connection
Your router has not established a DSL connection to your local exchange. The DSL light on the router will blink while it is trying to connect, and stay on if it connects successfully.
Restart the Internet/Wireless Setup Wizard
Continue to Wireless Setup wizard? Yes No
Next >
Exit

If the wizard still cannot detect a connection type and the following screen appears (see Figure 45 on page 79), click **Next** and refer to Section 5.2.2 on page 79 on how to configure the ZyXEL Device for Internet access manually.

Figure 45 Auto Detection: Failed

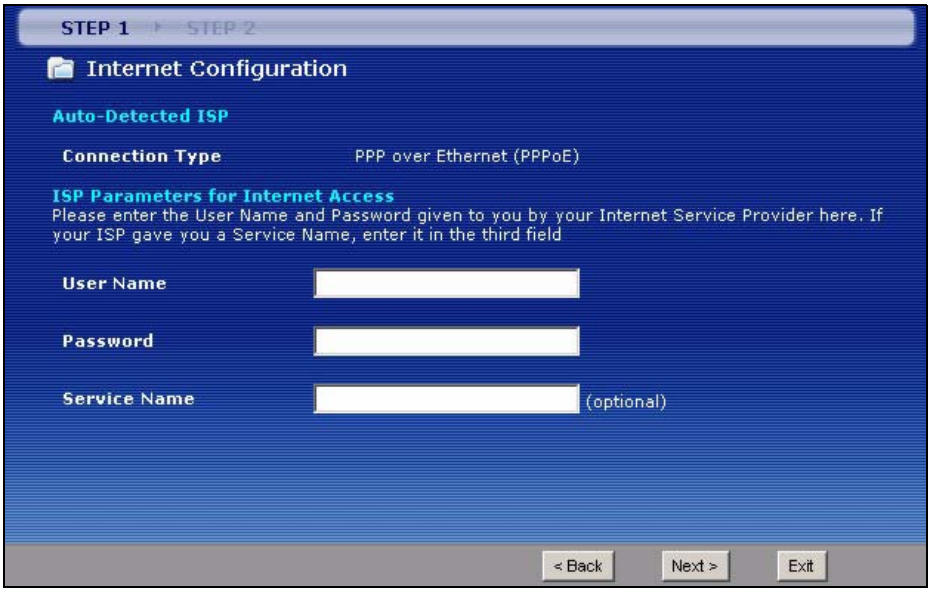

STEP 1
STEP 2
Internet Configuration
Auto-Detected ISP
Connection Type
Detection Failed. Please make sure the DSL cable is connected. Click the 'Next' button below to manually configure your Internet connection
Note:
This wizard can only automatically detect PPP over Ethernet (PPPoE), PPP over ATM (PPPoA), or dynamically assigned Ethernet Internet connections. Your Internet connection may use a Static IP address which cannot be detected automatically.
<Back
Next >
Exit

5.2.1 Automatic Detection

1 If you have a PPPoE or PPPoA connection, a screen displays prompting you to enter your Internet account information. Enter the username, password and/or service name exactly as provided.

2 Click **Next** and see Section 5.3 on page 84 for wireless connection wizard setup.

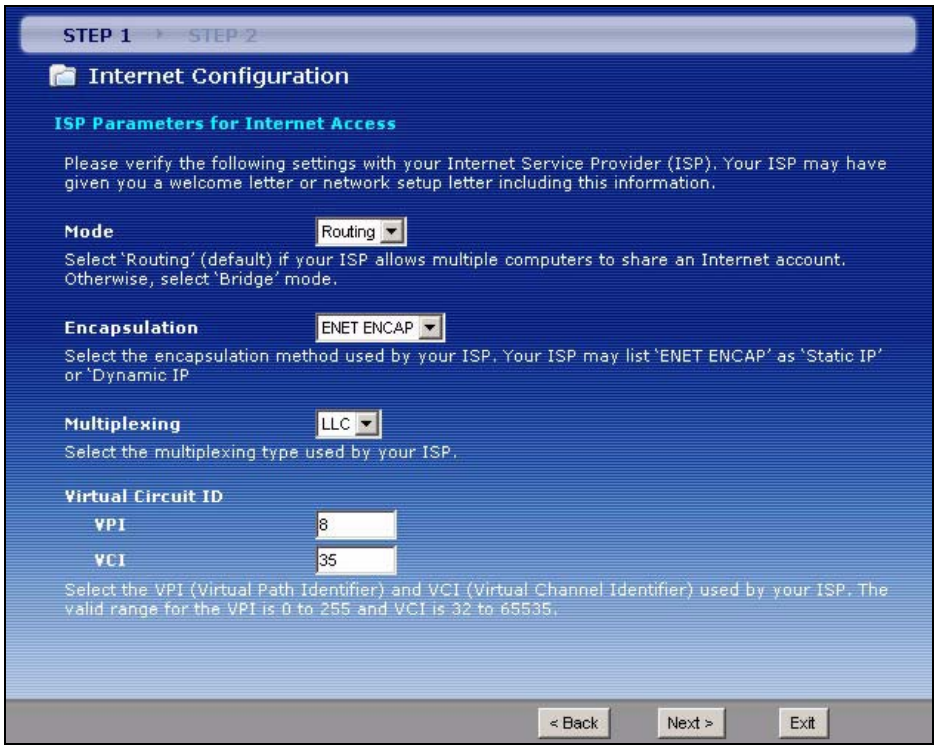
Figure 46 Auto-Detection: PPPoE


STEP 1
STEP 2
Internet Configuration
Auto-Detected ISP
Connection Type
PPP over Ethernet (PPPoE)
ISP Parameters for Internet Access
Please enter the User Name and Password given to you by your Internet Service Provider here. If your ISP gave you a Service Name, enter it in the third field
User Name
Password
Service Name
(optional)
< Back
Next >
Exit

5.2.2 Manual Configuration

1 If the ZyXEL Device fails to detect your DSL connection type, enter the Internet access information given to you by your ISP exactly in the wizard screen. If not given, leave the fields set to the default.

Figure 47 Internet Access Wizard Setup: ISP Parameters


STEP 1
STEP 2
Internet Configuration
ISP Parameters for Internet Access
Please verify the following settings with your Internet Service Provider (ISP). Your ISP may have given you a welcome letter or network setup letter including this information.
Mode
Routing
Select 'Routing' (default) if your ISP allows multiple computers to share an Internet account. Otherwise, select 'Bridge' mode.
Encapsulation
ENET ENCAP
Select the encapsulation method used by your ISP. Your ISP may list 'ENET ENCAP' as 'Static IP' or 'Dynamic IP
Multiplexing
LLC
Select the multiplexing type used by your ISP.
Virtual Circuit ID
VPI
8
VCI
35
Select the VPI (Virtual Path Identifier) and VCI (Virtual Channel Identifier) used by your ISP. The valid range for the VPI is 0 to 255 and VCI is 32 to 65535.
< Back
Next >
Exit

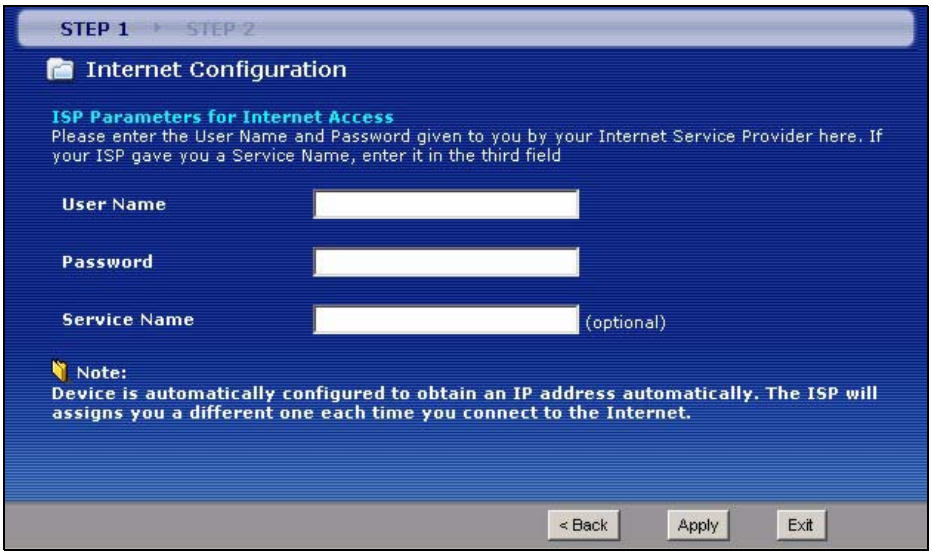
The following table describes the fields in this screen.

Table 21 Internet Access Wizard Setup: ISP Parameters

LABEL	DESCRIPTION
Mode	From the **Mode** drop-down list box, select **Routing** (default) if your ISP allows multiple computers to share an Internet account. Otherwise select **Bridge**.
Encapsulation	Select the encapsulation type your ISP uses from the **Encapsulation** drop-down list box. Choices vary depending on what you select in the **Mode** field. If you select **Bridge** in the **Mode** field, select either **PPPoA** or **RFC 1483**. If you select **Routing** in the **Mode** field, select **PPPoA**, **RFC 1483**, **ENET ENCAP** or **PPPoE**.
Multiplexing	Select the multiplexing method used by your ISP from the **Multiplex** drop-down list box either VC-based or LLC-based.
Virtual Circuit ID	VPI (Virtual Path Identifier) and VCI (Virtual Channel Identifier) define a virtual circuit. Refer to the appendix for more information.
VPI	Enter the VPI assigned to you. This field may already be configured.
VCI	Enter the VCI assigned to you. This field may already be configured.
Back	Click **Back** to go back to the previous screen.
Next	Click **Next** to continue to the next wizard screen. The next wizard screen you see depends on what protocol you chose above.
Exit	Click **Exit** to close the wizard screen without saving your changes.

2 The next wizard screen varies depending on what mode and encapsulation type you use. All screens shown are with routing mode. Configure the fields and click **Next** to continue. See Section 5.3 on page 84 for wireless connection wizard setup

Figure 48 Internet Connection with PPPoE

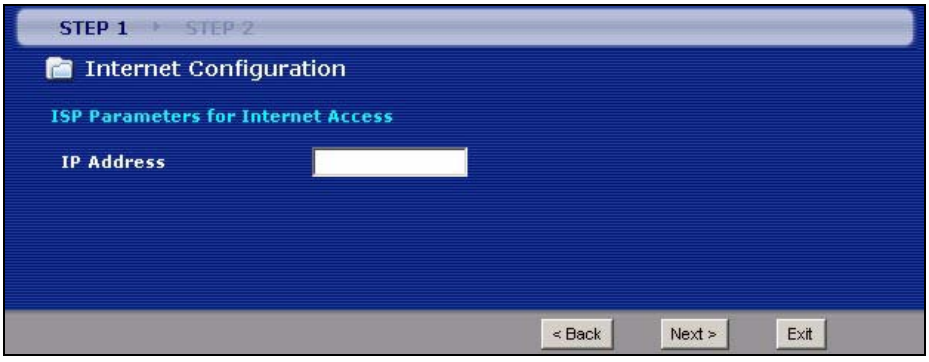

STEP 1
STEP 2
Internet Configuration
ISP Parameters for Internet Access
Please enter the User Name and Password given to you by your Internet Service Provider here. If your ISP gave you a Service Name, enter it in the third field
User Name
Password
Service Name
(optional)
Note:
Device is automatically configured to obtain an IP address automatically. The ISP will assigns you a different one each time you connect to the Internet.
< Back
Apply
Exit

The following table describes the fields in this screen.

Table 22 Internet Connection with PPPoE

LABEL	DESCRIPTION
User Name	Enter the user name exactly as your ISP assigned. If assigned a name in the form user@domain where domain identifies a service name, then enter both components exactly as given.
Password	Enter the password associated with the user name above.
Service Name	Type the name of your PPPoE service here.
Back	Click **Back** to go back to the previous wizard screen.
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Exit	Click **Exit** to close the wizard screen without saving your changes.

Figure 49 Internet Connection with RFC 1483



The following table describes the fields in this screen.

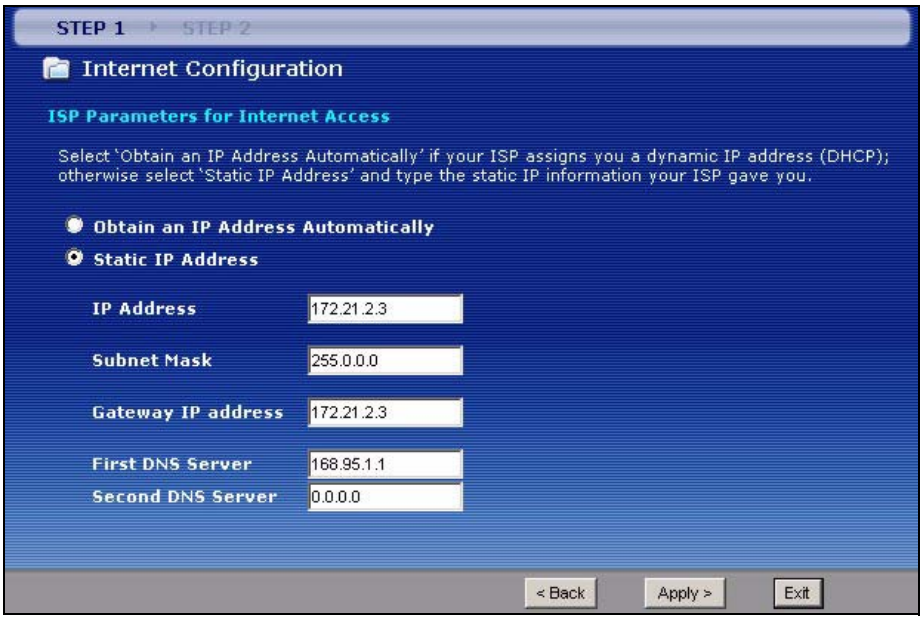
Table 23 Internet Connection with RFC 1483

LABEL	DESCRIPTION
IP Address	This field is available if you select **Routing** in the **Mode** field. Type your ISP assigned IP address in this field.
Back	Click **Back** to go back to the previous wizard screen.

Table 23 Internet Connection with RFC 1483 (continued)

LABEL	DESCRIPTION
Next	Click **Next** to continue to the next wizard screen.
Exit	Click **Exit** to close the wizard screen without saving your changes.

Figure 50 Internet Connection with ENET ENCAP



The following table describes the fields in this screen.

Table 24 Internet Connection with ENET ENCAP

LABEL	DESCRIPTION
Obtain an IP Address Automatically	A static IP address is a fixed IP that your ISP gives you. A dynamic IP address is not fixed; the ISP assigns you a different one each time you connect to the Internet. Select **Obtain an IP Address Automatically** if you have a dynamic IP address.
Static IP Address	Select **Static IP Address** if your ISP gives you a fixed IP address.
IP Address	Enter your ISP assigned IP address.
Subnet Mask	Enter a subnet mask in dotted decimal notation. Refer to the appendices to calculate a subnet mask If you are implementing subnetting.
Gateway IP address	You must specify a gateway IP address (supplied by your ISP) when you use **ENET ENCAP** in the **Encapsulation** field in the previous screen.
First DNS Server	Enter the IP addresses of the DNS servers. The DNS servers are passed to the DHCP clients along with the IP address and the subnet mask.
Second DNS Server	As above.
Back	Click **Back** to go back to the previous wizard screen.
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Exit	Click **Exit** to close the wizard screen without saving your changes.

Figure 51 Internet Connection with PPPoA

STEP 1
STEP 2
Internet Configuration
ISP Parameters for Internet Access
Please enter the User Name and Password given to you by your Internet Service Provider here
User Name
Password
Note:
Device is automatically configured to obtain an IP address automatically. The ISP will assigns you a different one each time you connect to the Internet.
< Back
Apply
Exit

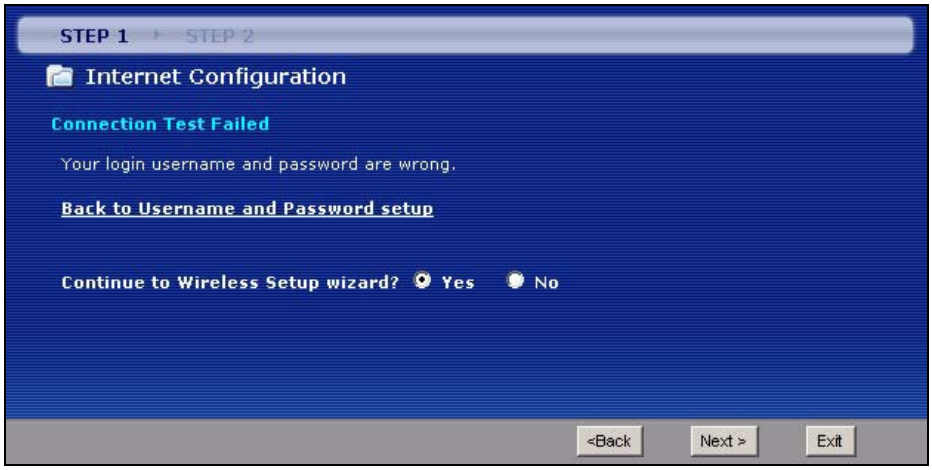
The following table describes the fields in this screen.

Table 25 Internet Connection with PPPoA

LABEL	DESCRIPTION
User Name	Enter the login name that your ISP gives you.
Password	Enter the password associated with the user name above.
Back	Click **Back** to go back to the previous wizard screen.
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Exit	Click **Exit** to close the wizard screen without saving your changes.

- If the user name and/or password you entered for PPPoE or PPPoA connection are not correct, the screen displays as shown next. Click **Back to Username and Password setup** to go back to the screen where you can modify them.

Figure 52 Connection Test Failed-1



- If the following screen displays, check if your account is activated or click **Restart the Internet/Wireless Setup Wizard** to verify your Internet access settings.

Figure 53 Connection Test Failed-2.

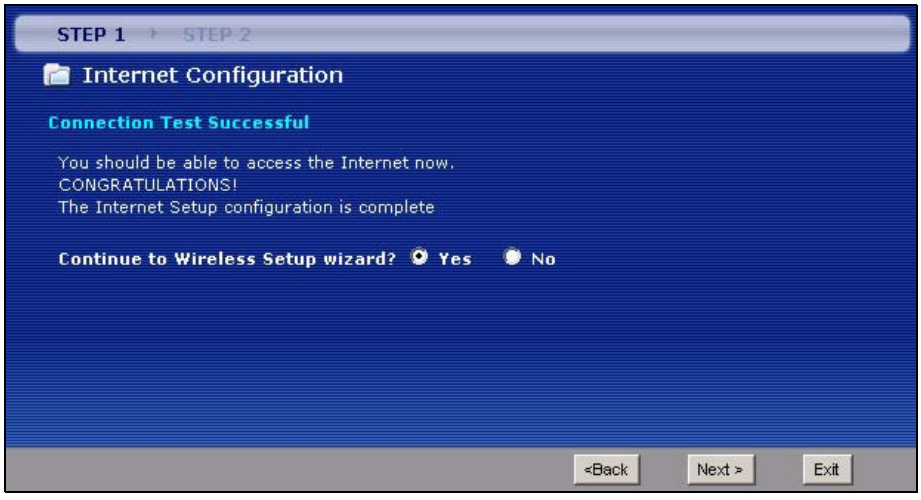
STEP 1
STEP 2
Internet Configuration
Connection Test Failed
Cannot access the Internet, please check your ISP account is active and that the settings you entered in the wizard are correct. If you still have problems, please contact customer support.
Restart the Internet/Wireless Setup Wizard
Continue to Wireless Setup wizard? Yes No
<Back
Next >
Exit

5.3 Wireless Connection Wizard Setup

After you configure the Internet access information, use the following screens to set up your wireless LAN.

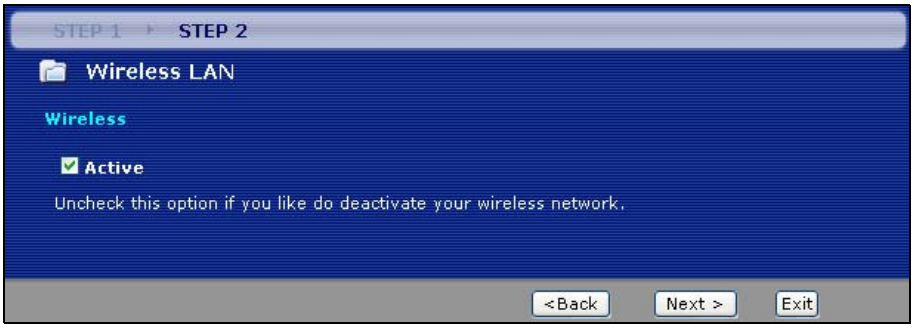
1 Select **Yes** and click **Next** to configure wireless settings. Otherwise, select **No** and skip to Step 6.

Figure 54 Connection Test Successful



2 Use this screen to activate the wireless LAN and OTIST. Click **Next** to continue.

Figure 55 Wireless LAN Setup Wizard 1



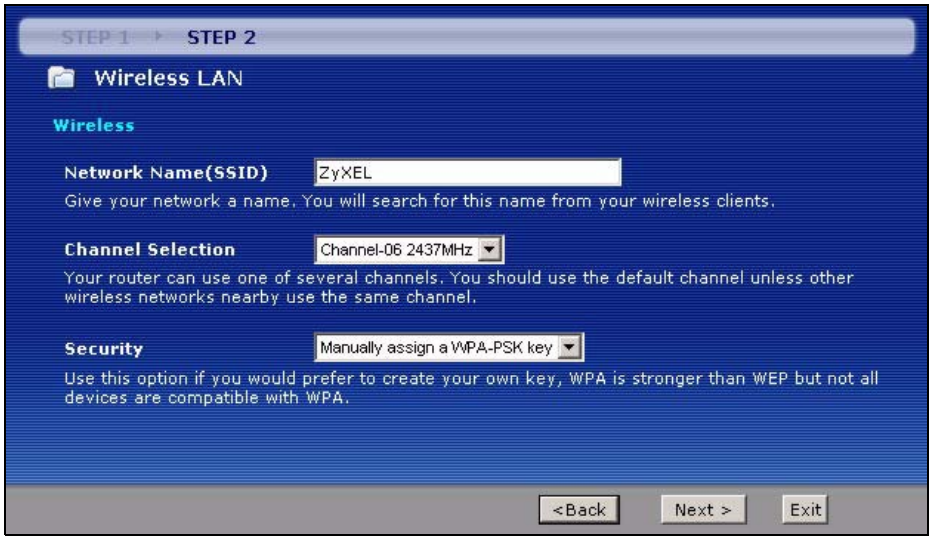
The following table describes the labels in this screen.

Table 26 Wireless LAN Setup Wizard 1

LABEL	DESCRIPTION
Active	Select the check box to turn on the wireless LAN.
Back	Click **Back** to display the previous screen.
Next	Click **Next** to proceed to the next screen.
Exit	Click **Exit** to close the wizard screen without saving.

3 Configure your wireless settings in this screen. Click **Next**.

Figure 56 Wireless LAN Setup Wizard 2


STEP 1
STEP 2
Wireless LAN
Wireless
Network Name(SSID)
ZyXEL
Give your network a name. You will search for this name from your wireless clients.
Channel Selection
Channel-06 2437MHz
Your router can use one of several channels. You should use the default channel unless other wireless networks nearby use the same channel.
Security
Manually assign a WPA-PSK key
Use this option if you would prefer to create your own key, WPA is stronger than WEP but not all devices are compatible with WPA.
<Back
Next >
Exit

The following table describes the labels in this screen.

Table 27 Wireless LAN Setup Wizard 2

LABEL	DESCRIPTION
Network Name(SSID)	Enter a descriptive name (up to 32 printable 7-bit ASCII characters) for the wireless LAN. If you change this field on the ZyXEL Device, make sure all wireless stations use the same SSID in order to access the network.
Channel Selection	The range of radio frequencies used by IEEE 802.11b/g wireless devices is called a channel. Select a channel ID that is not already in use by a neighboring device.

Table 27 Wireless LAN Setup Wizard 2

LABEL	DESCRIPTION
Security	Select **Manually assign a WPA-PSK key** to configure a pre-shared key (WPA-PSK). Choose this option only if your wireless clients support WPA. See Section 5.3.1 on page 86 for more information. Select **Manually assign a WEP key** to configure a WEP Key. See Section 5.3.2 on page 87 for more information. Select **Disable wireless security** to have no wireless LAN security configured and your network is accessible to any wireless networking device that is within range.
Back	Click **Back** to display the previous screen.
Next	Click **Next** to proceed to the next screen.
Exit	Click **Exit** to close the wizard screen without saving.

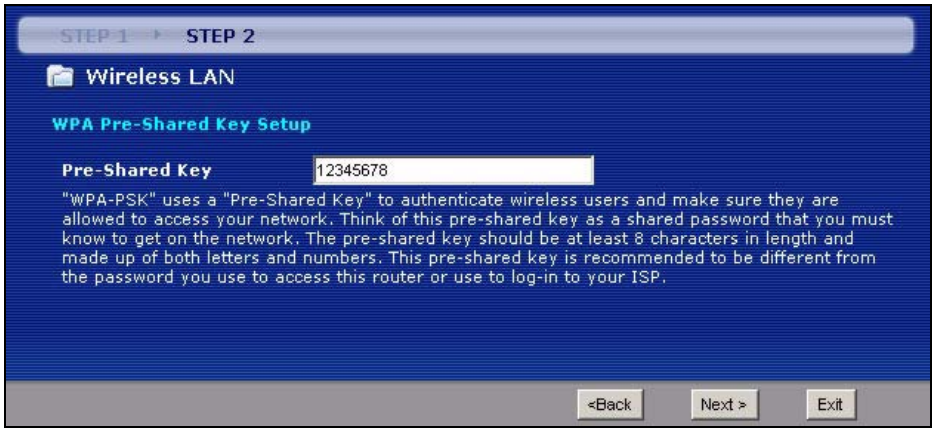
The wireless stations and ZyXEL Device must use the same SSID, channel ID and WEP encryption key (if WEP is enabled), WPA-PSK (if WPA-PSK is enabled) for wireless communication.

4 This screen varies depending on the security mode you selected in the previous screen. Fill in the field (if available) and click **Next**.

5.3.1 Manually assign a WPA-PSK key

Choose **Manually assign a WPA-PSK key** in the Wireless LAN setup screen to set up a **Pre-Shared Key**.

Figure 57 Manually assign a WPA-PSK key


STEP 1
STEP 2
Wireless LAN
WPA Pre-Shared Key Setup
Pre-Shared Key
12345678
"WPA-PSK" uses a "Pre-Shared Key" to authenticate wireless users and make sure they are allowed to access your network. Think of this pre-shared key as a shared password that you must know to get on the network. The pre-shared key should be at least 8 characters in length and made up of both letters and numbers. This pre-shared key is recommended to be different from the password you use to access this router or use to log-in to your ISP.
<Back
Next >
Exit

The following table describes the labels in this screen.

Table 28 Manually assign a WPA key

LABEL	DESCRIPTION
Pre-Shared Key	Type from 8 to 63 case-sensitive ASCII characters. You can set up the most secure wireless connection by configuring WPA in the wireless LAN screens. You need to configure an authentication server to do this.
Back	Click **Back** to display the previous screen.

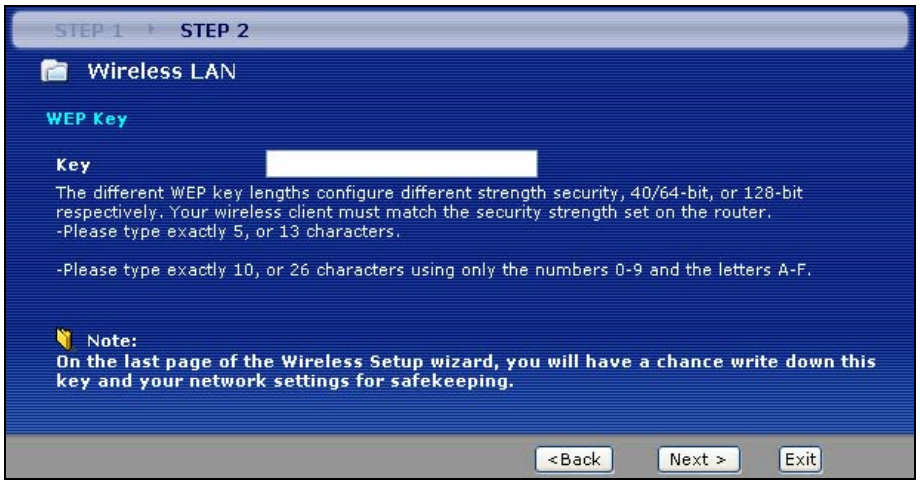
Table 28 Manually assign a WPA key

LABEL	DESCRIPTION
Next	Click **Next** to proceed to the next screen.
Exit	Click **Exit** to close the wizard screen without saving.

5.3.2 Manually assign a WEP key

Choose **Manually assign a WEP key** to setup WEP Encryption parameters.

Figure 58 Manually assign a WEP key


STEP 1
STEP 2
Wireless LAN
WEP Key
Key
The different WEP key lengths configure different strength security, 40/64-bit, or 128-bit respectively. Your wireless client must match the security strength set on the router.
-Please type exactly 5, or 13 characters.
-Please type exactly 10, or 26 characters using only the numbers 0-9 and the letters A-F.
Note:
On the last page of the Wireless Setup wizard, you will have a chance write down this key and your network settings for safekeeping.
<Back
Next >
Exit

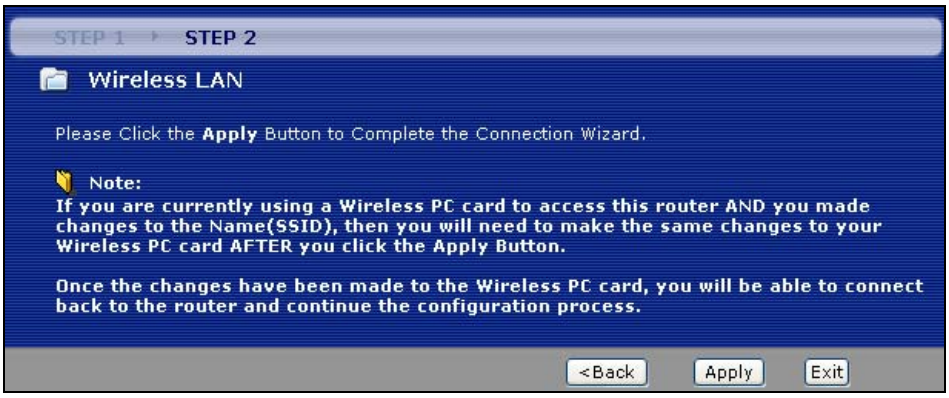
The following table describes the labels in this screen.

Table 29 Manually assign a WEP key

LABEL	DESCRIPTION
Key	The WEP keys are used to encrypt data. Both the ZyXEL Device and the wireless stations must use the same WEP key for data transmission. Enter any 5 or 13 ASCII characters or 10 or 26 hexadecimal characters ("0-9", "A-F") for a 64-bit or 128-bit WEP key respectively.
Back	Click **Back** to display the previous screen.
Next	Click **Next** to proceed to the next screen.
Exit	Click **Exit** to close the wizard screen without saving.

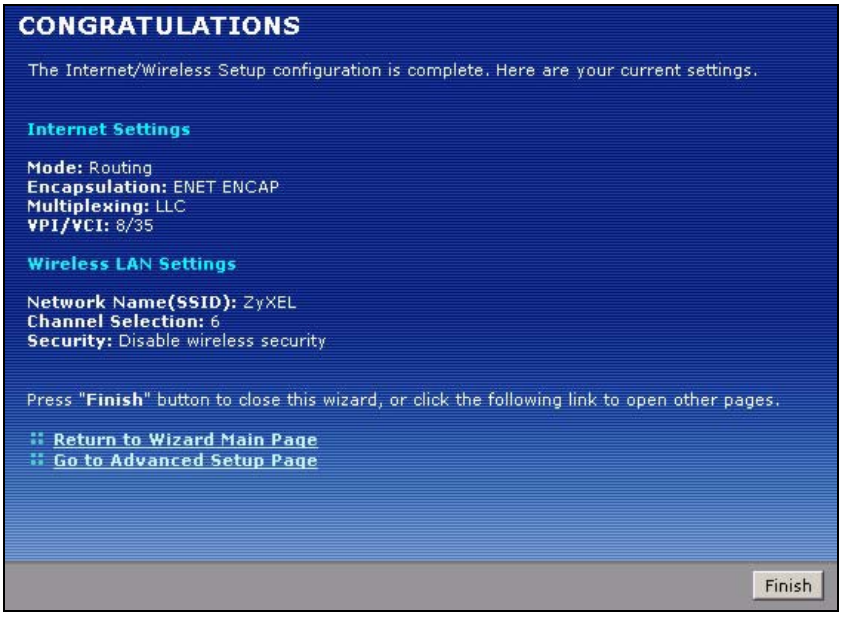
5 Click **Apply** to save your wireless LAN settings.

Figure 59 Wireless LAN Setup 3


STEP 1
STEP 2
Wireless LAN
Please Click the Apply Button to Complete the Connection Wizard.
Note:
If you are currently using a Wireless PC card to access this router AND you made changes to the Name(SSID), then you will need to make the same changes to your Wireless PC card AFTER you click the Apply Button.
Once the changes have been made to the Wireless PC card, you will be able to connect back to the router and continue the configuration process.
<Back
Apply
Exit

6 Use the read-only summary table to check whether what you have configured is correct. Click **Finish** to complete and save the wizard setup.

Figure 60 Internet Access and WLAN Wizard Setup Complete


CONGRATULATIONS
The Internet/Wireless Setup configuration is complete. Here are your current settings.
Internet Settings
Mode: Routing
Encapsulation: ENET ENCAP
Multiplexing: LLC
VPI/VCI: 8/35
Wireless LAN Settings
Network Name(SSID): ZyXEL
Channel Selection: 6
Security: Disable wireless security
Press "Finish" button to close this wizard, or click the following link to open other pages.
Return to Wizard Main Page
Go to Advanced Setup Page
Finish

7 Launch your web browser and navigate to www.zyxel.com. Internet access is just the beginning. Refer to the rest of this guide for more detailed information on the complete range of ZyXEL Device features. If you cannot access the Internet, open the web configurator again to confirm that the Internet settings you configured in the wizard setup are correct.

6

Bandwidth Management Wizard

This chapter shows you how to configure basic bandwidth management using the wizard screens.

6.1 Introduction

Bandwidth management allows you to control the amount of bandwidth going out through the ZyXEL Device's WAN port and prioritize the distribution of the bandwidth according to service bandwidth requirements. This helps keep one service from using all of the available bandwidth and shutting out other users.

6.2 Predefined Media Bandwidth Management Services

The following is a description of the services that you can select and to which you can apply media bandwidth management using the wizard screens.

Table 30 Media Bandwidth Management Setup: Services

SERVICE	DESCRIPTION
E-Mail	Electronic mail consists of messages sent through a computer network to specific groups or individuals. Here are some default ports for e-mail: POP3 - port 110 IMAP - port 143 SMTP - port 25 HTTP - port 80
FTP	File Transfer Protocol enables fast transfer of files, including large files that may not be possible by e-mail. FTP uses port number 21.
NetMeeting (H.323)	A multimedia communications product from Microsoft that enables groups to teleconference and videoconference over the Internet. NetMeeting supports VoIP, text chat sessions, a whiteboard, file transfers and application sharing. NetMeeting uses H.323. H.323 is a standard teleconferencing protocol suite that provides audio, data and video conferencing. It allows for real-time point-to-point and multipoint communication between client computers over a packet-based network that does not provide a guaranteed quality of service. H.323 is transported primarily over TCP, using the default port number 1720.
VoIP (H.323)	Sending voice signals over the Internet is called Voice over IP or VoIP. H.323 is a standard teleconferencing protocol suite that provides audio, data and video conferencing. It allows for real-time point-to-point and multipoint communication between client computers over a packet-based network that does not provide a guaranteed quality of service. H.323 is transported primarily over TCP, using the default port number 1720.

Table 30 Media Bandwidth Management Setup: Services (continued)

SERVICE	DESCRIPTION
VoIP (SIP)	Sending voice signals over the Internet is called Voice over IP or VoIP. Session Initiated Protocol (SIP) is an internationally recognized standard for implementing VoIP. SIP is an application-layer control (signaling) protocol that handles the setting up, altering and tearing down of voice and multimedia sessions over the Internet. SIP is transported primarily over UDP but can also be transported over TCP, using the default port number 5060.
Telnet	Telnet is the login and terminal emulation protocol common on the Internet and in UNIX environments. It operates over TCP/IP networks. Its primary function is to allow users to log into remote host systems. Telnet uses TCP port 23.
TFTP	Trivial File Transfer Protocol is an Internet file transfer protocol similar to FTP, but uses the UDP (User Datagram Protocol) rather than TCP (Transmission Control Protocol).
WWW	The World Wide Web (WWW) is an Internet system to distribute graphical, hyper-linked information, based on Hyper Text Transfer Protocol (HTTP) - a client/server protocol for the World Wide Web. The Web is not synonymous with the Internet; rather, it is just one service on the Internet. Other services on the Internet include Internet Relay Chat and Newsgroups. The Web is accessed through use of a browser.
XBOX Live	This is Microsoft's online gaming service that lets you play multiplayer Xbox games on the Internet via broadband technology. Xbox Live uses port 3074.
eMule	This program uses advanced file sharing applications relying on central servers to search for files. eMule uses default port 4662.

6.3 Bandwidth Management Wizard Setup

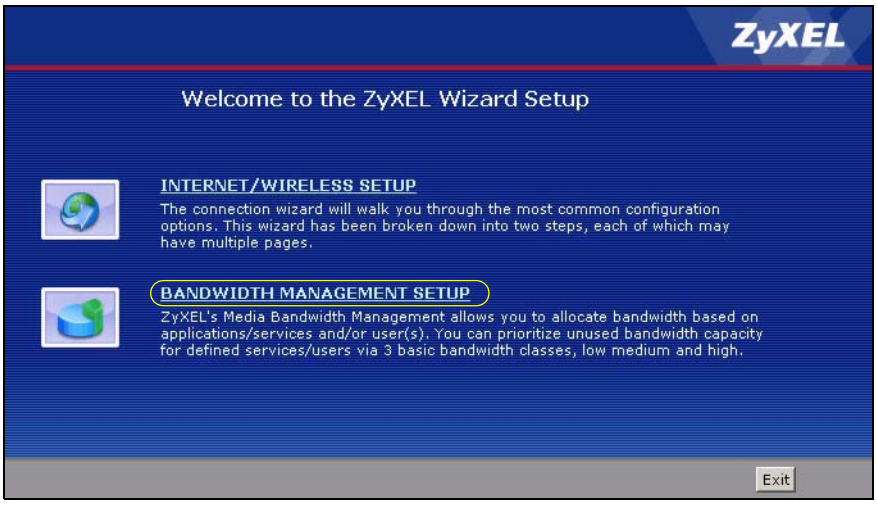
1 After you enter the admin password to access the web configurator, select **Go to Wizard setup** and click **Apply**. Otherwise, click the wizard icon ( ) in the top right corner of the web configurator to display the wizard main screen.

Figure 61 Select a Mode

ZyXEL
Please select Wizard or Advanced mode
The Wizard setup walks you through the most common configuration settings. We suggest you use this mode if it is the first time you are setting up your router or if you need to make basic configuration changes.
Use Advanced mode if you need access to more advanced features not included in Wizard mode.
Go to Wizard setup
Go to Advanced setup
Click here to always start with the Advanced setup.
Apply
Exit

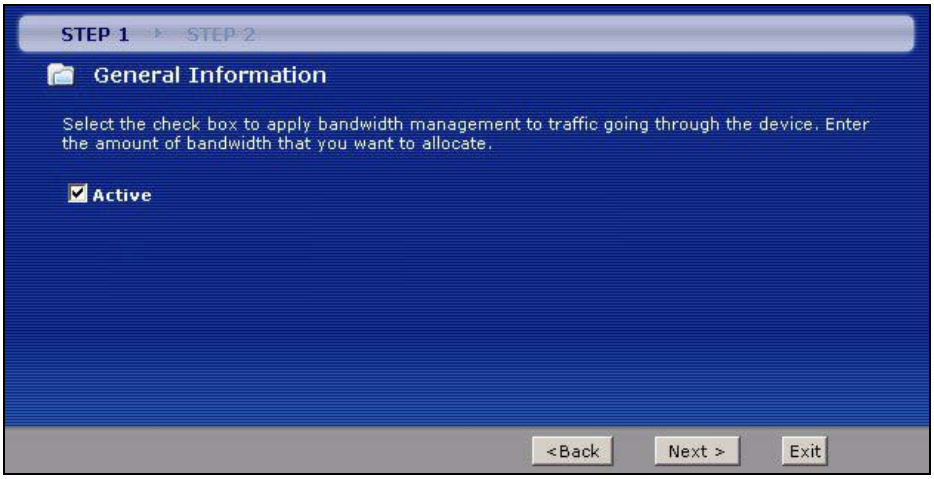
2 Click **BANDWIDTH MANAGEMENT SETUP** to configure the system for Internet access and wireless connection.

Figure 62 Wizard: Welcome


ZyXEL
Welcome to the ZyXEL Wizard Setup
INTERNET/WIRELESS SETUP
The connection wizard will walk you through the most common configuration options. This wizard has been broken down into two steps, each of which may have multiple pages.
BANDWIDTH MANAGEMENT SETUP
ZyXEL's Media Bandwidth Management allows you to allocate bandwidth based on applications/services and/or user(s). You can prioritize unused bandwidth capacity for defined services/users via 3 basic bandwidth classes, low medium and high.
Exit

3 Activate bandwidth management and select to allocate bandwidth to packets based on the service requirements.

Figure 63 Bandwidth Management Wizard: General Information


STEP 1
STEP 2
General Information
Select the check box to apply bandwidth management to traffic going through the device. Enter the amount of bandwidth that you want to allocate.
Active
<Back
Next >
Exit

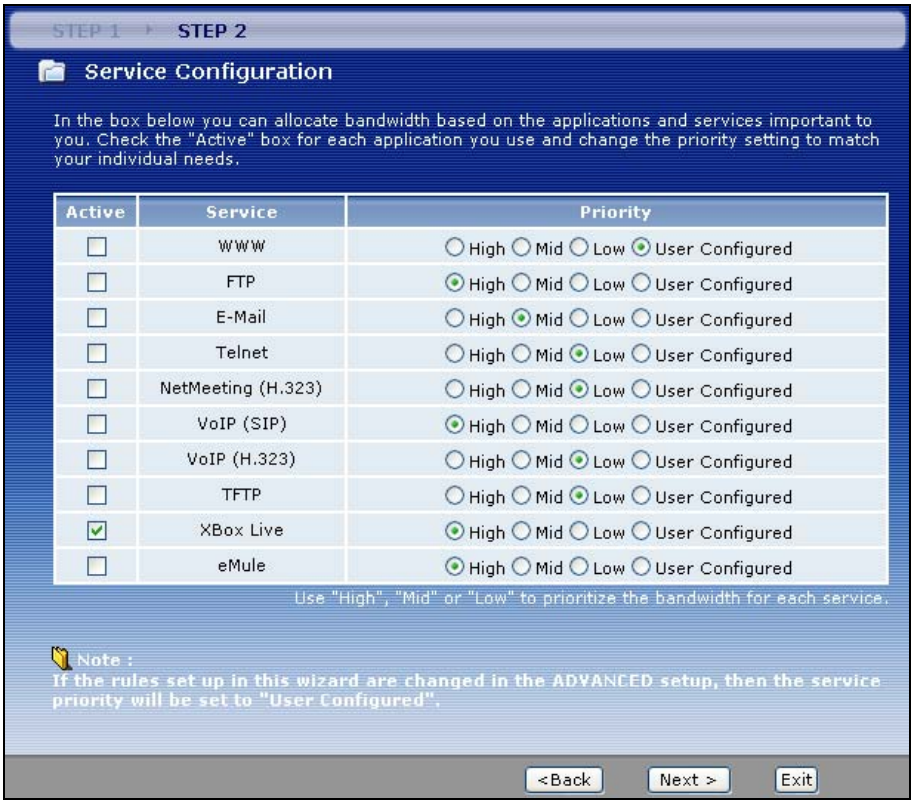
The following fields describe the label in this screen.

Table 31 Bandwidth Management Wizard: General Information

LABEL	DESCRIPTION
Active	Select the **Active** check box to have the ZyXEL Device apply bandwidth management to traffic going out through the ZyXEL Device's port(s). Select **Services Setup** to allocate bandwidth based on the service requirements.
Back	Click **Back** to display the previous screen.
Next	Click **Next** to proceed to the next screen.
Exit	Click **Exit** to close the wizard screen without saving.

4 Use the second wizard screen to select the services that you want to apply bandwidth management and select the priorities that you want to apply to the services listed.

Figure 64 Bandwidth Management Wizard: Configuration


STEP 1
STEP 2
Service Configuration
In the box below you can allocate bandwidth based on the applications and services important to you. Check the "Active" box for each application you use and change the priority setting to match your individual needs.
Active
Service
Priority
WWW
FTP
E-Mail
Telnet
NetMeeting (H.323)
VoIP (SIP)
VoIP (H.323)
TFTP
XBox Live
eMule
High Mid Low User Configured
Use "High", "Mid" or "Low" to prioritize the bandwidth for each service.
Note :
If the rules set up in this wizard are changed in the ADVANCED setup, then the service priority will be set to "User Configured".
<Back
Next >
Exit

The following table describes the labels in this screen.

Table 32 Bandwidth Management Wizard: Configuration

LABEL	DESCRIPTION
Active	Select an entry's **Active** check box to turn on bandwidth management for the service/ application.
Service	These fields display the services names.
Priority	Select **High**, **Mid** or **Low** priority for each service to have your ZyXEL Device use a priority for traffic that matches that service. A service with **High** priority is given as much bandwidth as it needs. If you select services as having the same priority, then bandwidth is divided equally amongst those services. Services not specified in bandwidth management are allocated bandwidth after all specified services receive their bandwidth requirements. If the rules set up in this wizard are changed in **Advanced** > **Bandwidth MGMT** > **Rule Setup**, then the service priority radio button will be set to **User Configured**. The **Advanced** > **Bandwidth MGMT** > **Rule Setup** screen allows you to edit these rule configurations.
Auto classifier rest bandwidth	Select **Auto classifier rest bandwidth** to automatically allocate unbudgeted or unused bandwidth to services based on the packet type.
Back	Click **Back** to go back to the previous wizard screen.
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Exit	Click **Exit** to close the wizard screen without saving your changes.

5 Follow the on-screen instructions and click **Finish** to complete the wizard setup and save your configuration.

Figure 65 Bandwidth Management Wizard: Complete

CONGRATULATIONS!
You have completed the Media Bandwidth Management setup. You can press "Finish" button to complete Bandwidth Management Setup.
Press "Finish" button to close this wizard, or click the following link to open other pages.
Return to Wizard Main Page
Go to Advanced Setup page
<Back
Finish

PART III
Network

WAN Setup (97)
LAN Setup (115)
Wireless LAN (127)
Network Address Translation (NAT) (147)

7

WAN Setup

This chapter describes how to configure WAN settings.

7.1 WAN Overview

A WAN (Wide Area Network) is an outside connection to another network or the Internet.

7.1.1 Encapsulation

Be sure to use the encapsulation method required by your ISP. The ZyXEL Device supports the following methods.

7.1.1.1 ENET ENCAP

The MAC Encapsulated Routing Link Protocol (ENET ENCAP) is only implemented with the IP network protocol. IP packets are routed between the Ethernet interface and the WAN interface and then formatted so that they can be understood in a bridged environment. For instance, it encapsulates routed Ethernet frames into bridged ATM cells. ENET ENCAP requires that you specify a gateway IP address in the **ENET ENCAP Gateway** field in the second wizard screen. You can get this information from your ISP.

7.1.1.2 PPP over Ethernet

PPPoE (Point-to-Point Protocol over Ethernet) provides access control and billing functionality in a manner similar to dial-up services using PPP. PPPoE is an IETF standard (RFC 2516) specifying how a personal computer (PC) interacts with a broadband modem (DSL, cable, wireless, etc.) connection.

For the service provider, PPPoE offers an access and authentication method that works with existing access control systems (for example RADIUS).

One of the benefits of PPPoE is the ability to let you access one of multiple network services, a function known as dynamic service selection. This enables the service provider to easily create and offer new IP services for individuals.

Operationally, PPPoE saves significant effort for both you and the ISP or carrier, as it requires no specific configuration of the broadband modem at the customer site.

By implementing PPPoE directly on the ZyXEL Device (rather than individual computers), the computers on the LAN do not need PPPoE software installed, since the ZyXEL Device does that part of the task. Furthermore, with NAT, all of the LANs' computers will have access.

7.1.1.3 PPPoA

PPPoA stands for Point to Point Protocol over ATM Adaptation Layer 5 (AAL5). A PPPoA connection functions like a dial-up Internet connection. The ZyXEL Device encapsulates the PPP session based on RFC1483 and sends it through an ATM PVC (Permanent Virtual Circuit) to the Internet Service Provider's (ISP) DSLAM (digital access multiplexer). Please refer to RFC 2364 for more information on PPPoA. Refer to RFC 1661 for more information on PPP.

7.1.1.4 RFC 1483

RFC 1483 describes two methods for Multiprotocol Encapsulation over ATM Adaptation Layer 5 (AAL5). The first method allows multiplexing of multiple protocols over a single ATM virtual circuit (LLC-based multiplexing) and the second method assumes that each protocol is carried over a separate ATM virtual circuit (VC-based multiplexing). Please refer to the RFC for more detailed information.

7.1.2 Multiplexing

There are two conventions to identify what protocols the virtual circuit (VC) is carrying. Be sure to use the multiplexing method required by your ISP.

7.1.2.1 VC-based Multiplexing

In this case, by prior mutual agreement, each protocol is assigned to a specific virtual circuit; for example, VC1 carries IP, etc. VC-based multiplexing may be dominant in environments where dynamic creation of large numbers of ATM VCs is fast and economical.

7.1.2.2 LLC-based Multiplexing

In this case one VC carries multiple protocols with protocol identifying information being contained in each packet header. Despite the extra bandwidth and processing overhead, this method may be advantageous if it is not practical to have a separate VC for each carried protocol, for example, if charging heavily depends on the number of simultaneous VCs.

7.1.3 Encapsulation and Multiplexing Scenarios

For Internet access you should use the encapsulation and multiplexing methods used by your ISP. Consult your telephone company for information on encapsulation and multiplexing methods for LAN-to-LAN applications, for example between a branch office and corporate headquarters. There must be prior agreement on encapsulation and multiplexing methods because they cannot be automatically determined. What method(s) you use also depends on how many VCs you have and how many different network protocols you need. The extra overhead that ENET ENCAP encapsulation entails makes it a poor choice in a LAN-to-LAN application. Here are some examples of more suitable combinations in such an application.

7.1.3.1 Scenario 1: One VC, Multiple Protocols

PPPoA (RFC-2364) encapsulation with **VC-based** multiplexing is the best combination because no extra protocol identifying headers are needed. The **PPP** protocol already contains this information.

7.1.3.2 Scenario 2: One VC, One Protocol (IP)

Selecting **RFC-1483** encapsulation with **VC-based** multiplexing requires the least amount of overhead (0 octets). However, if there is a potential need for multiple protocol support in the future, it may be safer to select **PPPoA** encapsulation instead of **RFC-1483**, so you do not need to reconfigure either computer later.

7.1.3.3 Scenario 3: Multiple VCs

If you have an equal number (or more) of VCs than the number of protocols, then select RFC-1483 encapsulation and VC-based multiplexing.

7.1.4 VPI and VCI

Be sure to use the correct Virtual Path Identifier (VPI) and Virtual Channel Identifier (VCI) numbers assigned to you. The valid range for the VPI is 0 to 255 and for the VCI is 32 to 65535 (0 to 31 is reserved for local management of ATM traffic). Please see the appendix for more information.

7.1.5 IP Address Assignment

A static IP is a fixed IP that your ISP gives you. A dynamic IP is not fixed; the ISP assigns you a different one each time. The Single User Account feature can be enabled or disabled if you have either a dynamic or static IP. However the encapsulation method assigned influences your choices for IP address and ENET ENCAP gateway.

7.1.5.1 IP Assignment with PPPoA or PPPoE Encapsulation

If you have a dynamic IP, then the **IP Address** and **ENET ENCAP Gateway** fields are not applicable (N/A). If you have a static IP, then you *only* need to fill in the **IP Address** field and *not* the **ENET ENCAP Gateway** field.

7.1.5.2 IP Assignment with RFC 1483 Encapsulation

In this case the IP Address Assignment *must* be static with the same requirements for the **IP Address** and **ENET ENCAP Gateway** fields as stated above.

7.1.5.3 IP Assignment with ENET ENCAP Encapsulation

In this case you can have either a static or dynamic IP. For a static IP you must fill in all the **IP Address** and **ENET ENCAP Gateway** fields as supplied by your ISP. However for a dynamic IP, the ZyXEL Device acts as a DHCP client on the WAN port and so the **IP Address** and **ENET ENCAP Gateway** fields are not applicable (N/A) as the DHCP server assigns them to the ZyXEL Device.

7.1.6 Nailed-Up Connection (PPP)

A nailed-up connection is a dial-up line where the connection is always up regardless of traffic demand. The ZyXEL Device does two things when you specify a nailed-up connection. The first is that idle timeout is disabled. The second is that the ZyXEL Device will try to bring up the connection when turned on and whenever the connection is down. A nailed-up connection can be very expensive for obvious reasons.

Do not specify a nailed-up connection unless your telephone company offers flat-rate service or you need a constant connection and the cost is of no concern

7.1.7 NAT

NAT (Network Address Translation - NAT, RFC 1631) is the translation of the IP address of a host in a packet, for example, the source address of an outgoing packet, used within one network to a different IP address known within another network.

7.2 Metric

The metric represents the "cost of transmission". A router determines the best route for transmission by choosing a path with the lowest "cost". RIP routing uses hop count as the measurement of cost, with a minimum of "1" for directly connected networks. The number must be between "1" and "15"; a number greater than "15" means the link is down. The smaller the number, the lower the "cost".

The metric sets the priority for the ZyXEL Device's routes to the Internet. If any two of the default routes have the same metric, the ZyXEL Device uses the following pre-defined priorities:

- Normal route: designated by the ISP (see Section 7.5 on page 102)
- Traffic-redirect route (see Section 7.7 on page 111)
- WAN-backup route, also called dial-backup (see Section 7.8 on page 112)

For example, if the normal route has a metric of "1" and the traffic-redirect route has a metric of "2" and dial-backup route has a metric of "3", then the normal route acts as the primary default route. If the normal route fails to connect to the Internet, the ZyXEL Device tries the traffic-redirect route next. In the same manner, the ZyXEL Device uses the dial-backup route if the traffic-redirect route also fails.

If you want the dial-backup route to take first priority over the traffic-redirect route or even the normal route, all you need to do is set the dial-backup route's metric to "1" and the others to "2" (or greater).

IP Policy Routing overrides the default routing behavior and takes priority over all of the routes mentioned above.

7.3 Traffic Shaping

Traffic Shaping is an agreement between the carrier and the subscriber to regulate the average rate and fluctuations of data transmission over an ATM network. This agreement helps eliminate congestion, which is important for transmission of real time data such as audio and video connections.

Peak Cell Rate (PCR) is the maximum rate at which the sender can send cells. This parameter may be lower (but not higher) than the maximum line speed. 1 ATM cell is 53 bytes (424 bits), so a maximum speed of 832Kbps gives a maximum PCR of 1962 cells/sec. This rate is not guaranteed because it is dependent on the line speed.

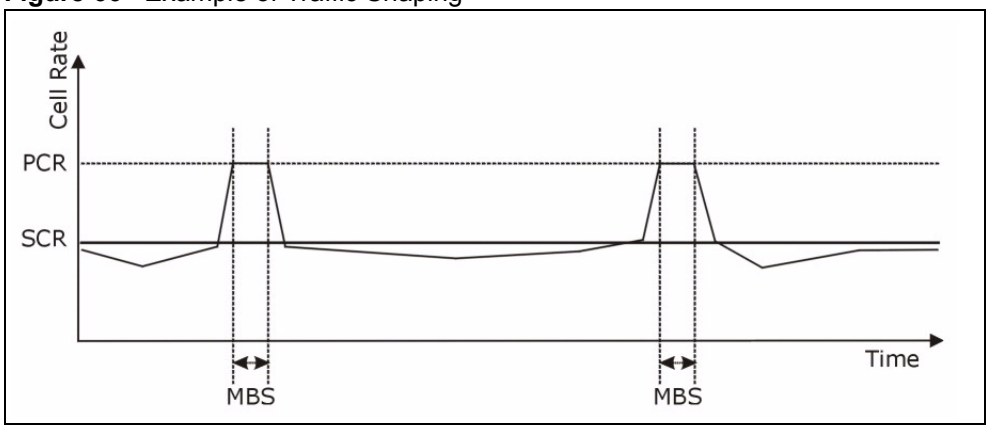
Sustained Cell Rate (SCR) is the mean cell rate of each bursty traffic source. It specifies the maximum average rate at which cells can be sent over the virtual connection. SCR may not be greater than the PCR.

Maximum Burst Size (MBS) is the maximum number of cells that can be sent at the PCR. After MBS is reached, cell rates fall below SCR until cell rate averages to the SCR again. At this time, more cells (up to the MBS) can be sent at the PCR again.

If the PCR, SCR or MBS is set to the default of "0", the system will assign a maximum value that correlates to your upstream line rate.

The following figure illustrates the relationship between PCR, SCR and MBS.

Figure 66 Example of Traffic Shaping



7.3.1 ATM Traffic Classes

These are the basic ATM traffic classes defined by the ATM Forum Traffic Management 4.0 Specification.

7.3.1.1 Constant Bit Rate (CBR)

Constant Bit Rate (CBR) provides fixed bandwidth that is always available even if no data is being sent. CBR traffic is generally time-sensitive (doesn't tolerate delay). CBR is used for connections that continuously require a specific amount of bandwidth. A PCR is specified and if traffic exceeds this rate, cells may be dropped. Examples of connections that need CBR would be high-resolution video and voice.

7.3.1.2 Variable Bit Rate (VBR)

The Variable Bit Rate (VBR) ATM traffic class is used with bursty connections. Connections that use the Variable Bit Rate (VBR) traffic class can be grouped into real time (VBR-RT) or non-real time (VBR-nRT) connections.

The VBR-RT (real-time Variable Bit Rate) type is used with bursty connections that require closely controlled delay and delay variation. It also provides a fixed amount of bandwidth (a PCR is specified) but is only available when data is being sent. An example of an VBR-RT connection would be video conferencing. Video conferencing requires real-time data transfers and the bandwidth requirement varies in proportion to the video image's changing dynamics.

The VBR-nRT (non real-time Variable Bit Rate) type is used with bursty connections that do not require closely controlled delay and delay variation. It is commonly used for "bursty" traffic typical on LANs. PCR and MBS define the burst levels, SCR defines the minimum level. An example of an VBR-nRT connection would be non-time sensitive data file transfers.

7.3.1.3 Unspecified Bit Rate (UBR)

The Unspecified Bit Rate (UBR) ATM traffic class is for bursty data transfers. However, UBR doesn't guarantee any bandwidth and only delivers traffic when the network has spare bandwidth. An example application is background file transfer.

7.4 Zero Configuration Internet Access

Once you turn on and connect the ZyXEL Device to a telephone jack, it automatically detects the Internet connection settings (such as the VCI/VPI numbers and the encapsulation method) from the ISP and makes the necessary configuration changes. In cases where additional account information (such as an Internet account user name and password) is required or the ZyXEL Device cannot connect to the ISP, you will be redirected to web screen(s) for information input or troubleshooting.

Zero configuration for Internet access is disable when

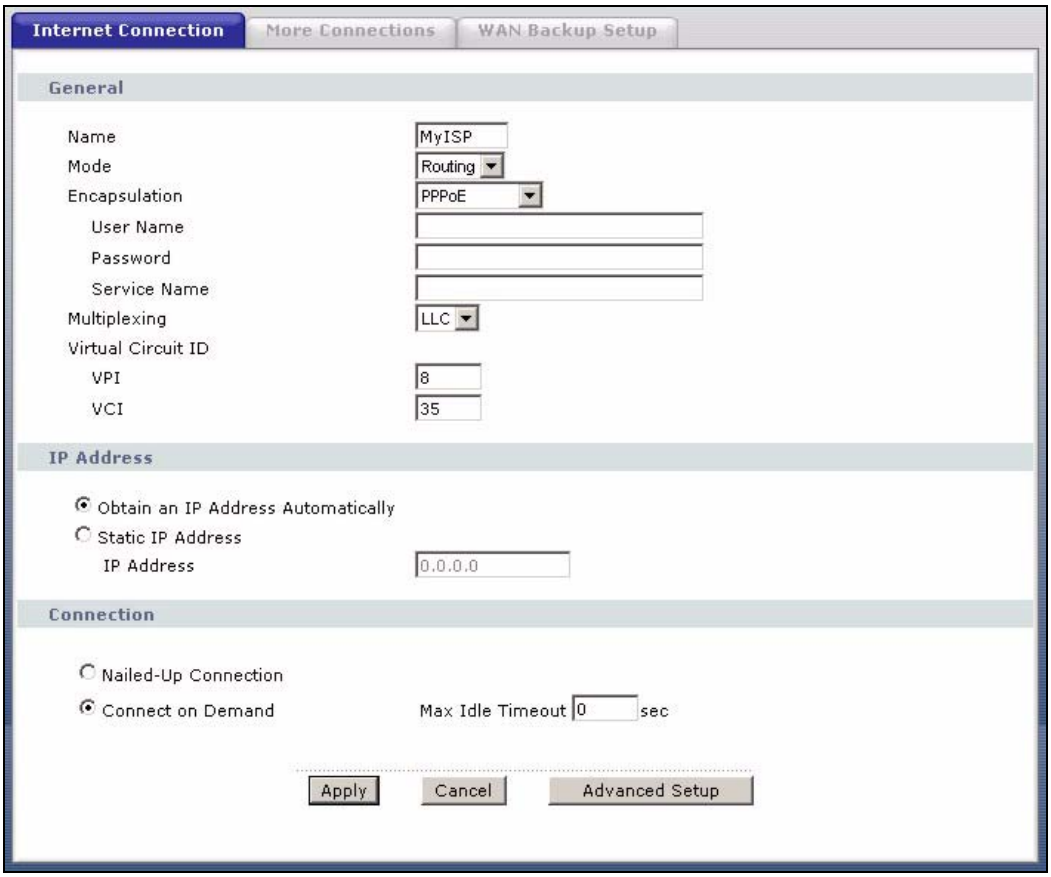
- the ZyXEL Device is in bridge mode
- you set the ZyXEL Device to use a static (fixed) WAN IP address.

7.5 Internet Connection

To change your ZyXEL Device's WAN Internet access settings, click **Network > WAN**. The screen differs by the encapsulation.

See Section 7.1 on page 97 for more information.

Figure 67 Internet Connection (PPPoE)



The following table describes the labels in this screen.

Table 33 Internet Connection

LABEL	DESCRIPTION
General	
Name	Enter the name of your Internet Service Provider, e.g., MyISP. This information is for identification purposes only.
Mode	Select **Routing** (default) from the drop-down list box if your ISP allows multiple computers to share an Internet account. Otherwise select **Bridge**.
Encapsulation	Select the method of encapsulation used by your ISP from the drop-down list box. Choices vary depending on the mode you select in the **Mode** field. If you select **Bridge** in the **Mode** field, select either **PPPoA** or **RFC 1483**. If you select **Routing** in the **Mode** field, select **PPPoA**, **RFC 1483**, **ENET ENCAP** or **PPPoE**.
User Name	(PPPoA and PPPoE encapsulation only) Enter the user name exactly as your ISP assigned. If assigned a name in the form user@domain where domain identifies a service name, then enter both components exactly as given.
Password	(PPPoA and PPPoE encapsulation only) Enter the password associated with the user name above.
Service Name	(PPPoE only) Type the name of your PPPoE service here.
Multiplexing	Select the method of multiplexing used by your ISP from the drop-down list. Choices are **VC** or **LLC**.

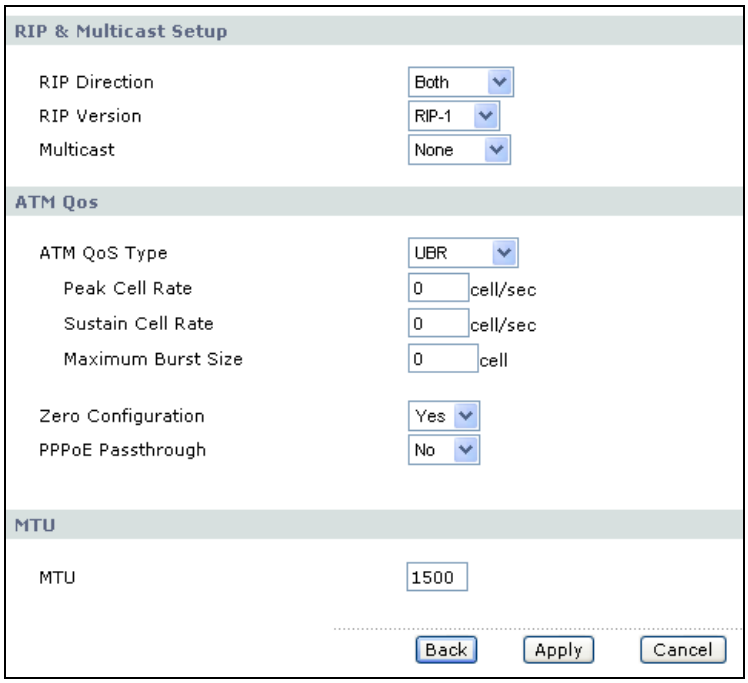
Table 33 Internet Connection (continued)

LABEL	DESCRIPTION
Virtual Circuit ID	VPI (Virtual Path Identifier) and VCI (Virtual Channel Identifier) define a virtual circuit. Refer to the appendix for more information.
VPI	The valid range for the VPI is 0 to 255. Enter the VPI assigned to you.
VCI	The valid range for the VCI is 32 to 65535 (0 to 31 is reserved for local management of ATM traffic). Enter the VCI assigned to you.
IP Address	This option is available if you select **Routing** in the **Mode** field. A static IP address is a fixed IP that your ISP gives you. A dynamic IP address is not fixed; the ISP assigns you a different one each time you connect to the Internet. If you use the encapsulation type except **RFC 1483**, select **Obtain an IP Address Automatically** when you have a dynamic IP address; otherwise select **Static IP Address** and type your ISP assigned IP address in the **IP Address** field below. If you use **RFC 1483**, enter the IP address given by your ISP in the **IP Address** field.
Subnet Mask (ENET ENCAP encapsulation only)	Enter a subnet mask in dotted decimal notation. Refer to the appendices to calculate a subnet mask If you are implementing subnetting.
Gateway IP address (ENET ENCAP encapsulation only)	You must specify a gateway IP address (supplied by your ISP) when you select **ENET ENCAP** in the **Encapsulation** field
Connection (PPPoA and PPPoE encapsulation only)	
Nailed-Up Connection	Select **Nailed-Up Connection** when you want your connection up all the time. The ZyXEL Device will try to bring up the connection automatically if it is disconnected.
Connect on Demand	Select **Connect on Demand** when you don't want the connection up all the time and specify an idle time-out in the **Max Idle Timeout** field.
Max Idle Timeout	Specify an idle time-out in the **Max Idle Timeout** field when you select **Connect on Demand**. The default setting is 0, which means the Internet session will not timeout.
Apply	Click **Apply** to save the changes.
Cancel	Click **Cancel** to begin configuring this screen afresh.
Advanced Setup	Click this button to display the **Advanced Internet Connection Setup** screen and edit more details of your WAN setup.

7.5.1 Configuring Advanced Internet Connection Setup

To edit your ZyXEL Device's advanced WAN settings, click the **Advanced Setup** button in the **Internet Connection** screen. The screen appears as shown.

Figure 68 Advanced Internet Connection Setup



The following table describes the labels in this screen.

Table 34 Advanced Internet Connection Setup

LABEL	DESCRIPTION
RIP & Multicast Setup	
RIP Direction	Select the RIP direction from **None**, **Both**, **In Only** and **Out Only**.
RIP Version	Select the RIP version from **RIP-1**, **RIP-2B** and **RIP-2M**.
Multicast	IGMP (Internet Group Management Protocol) is a network-layer protocol used to establish membership in a multicast group. The ZyXEL Device supports both IGMP version 1 (**IGMP-v1**) and **IGMP-v2**. Select **None** to disable it.
ATM QoS	
ATM QoS Type	Select **CBR** (Continuous Bit Rate) to specify fixed (always-on) bandwidth for voice or data traffic. Select **UBR** (Unspecified Bit Rate) for applications that are non-time sensitive, such as e-mail. Select **VBR-nRT** (Variable Bit Rate-non Real Time) or **VBR-RT** (Variable Bit Rate-Real Time) for bursty traffic and bandwidth sharing with other applications.
Peak Cell Rate	Divide the DSL line rate (bps) by 424 (the size of an ATM cell) to find the Peak Cell Rate (PCR). This is the maximum rate at which the sender can send cells. Type the PCR here.
Sustain Cell Rate	The Sustain Cell Rate (SCR) sets the average cell rate (long-term) that can be transmitted. Type the SCR, which must be less than the PCR. Note that system default is 0 cells/sec.
Maximum Burst Size	Maximum Burst Size (MBS) refers to the maximum number of cells that can be sent at the peak rate. Type the MBS, which is less than 65535.

Table 34 Advanced Internet Connection Setup (continued)

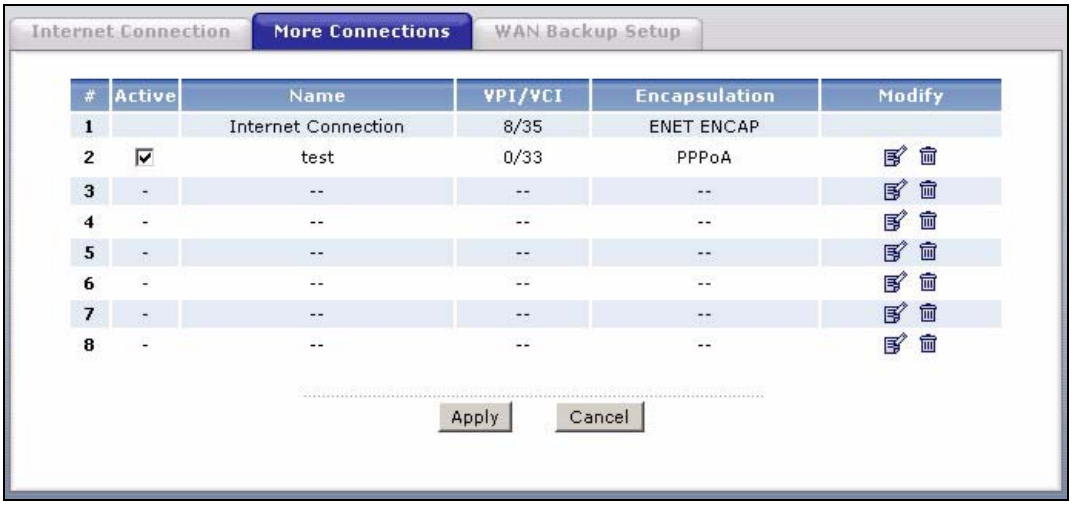
LABEL	DESCRIPTION
Zero Configuration	This feature is not applicable/available when you configure the ZyXEL Device to use a static WAN IP address or in bridge mode. Select **Yes** to set the ZyXEL Device to automatically detect the Internet connection settings (such as the VCI/VPI numbers and the encapsulation method) from the ISP and make the necessary configuration changes. Select **No** to disable this feature. You must manually configure the ZyXEL Device for Internet access.
PPPoE Passthrough	This feature is available when you select **PPPoE** encapsulation. In addition to the ZyXEL Device's built-in PPPoE client, you can enable PPPoE pass through to allow up to ten hosts on the LAN to use PPPoE client software on their computers to connect to the ISP via the ZyXEL Device. Each host can have a separate account and a public WAN IP address. PPPoE pass through is an alternative to NAT for application where NAT is not appropriate. Disable PPPoE pass through if you do not need to allow hosts on the LAN to use PPPoE client software on their computers to connect to the ISP.
MTU	
MTU	The Maximum Transmission Unit (MTU) defines the size of the largest packet allowed on an interface or connection. Enter the MTU in this field. For ENET ENCAP, the MTU value is 1500. For PPPoE, the MTU value is 1492. For PPPoA and RFC 1483, the MTU is 65535.
Back	Click **Back** to return to the previous screen.
Apply	Click **Apply** to save the changes.
Cancel	Click **Cancel** to begin configuring this screen afresh.

7.6 Configuring More Connections

This section describes the protocol-independent parameters for a remote network. They are required for placing calls to a remote gateway and the network behind it across a WAN connection. When you use the **WAN > Internet Connection** screen to set up Internet access, you are configuring the first WAN connection.

Click **Network > WAN > More Connections** to display the screen as shown next.

Figure 69 More Connections



The following table describes the labels in this screen.

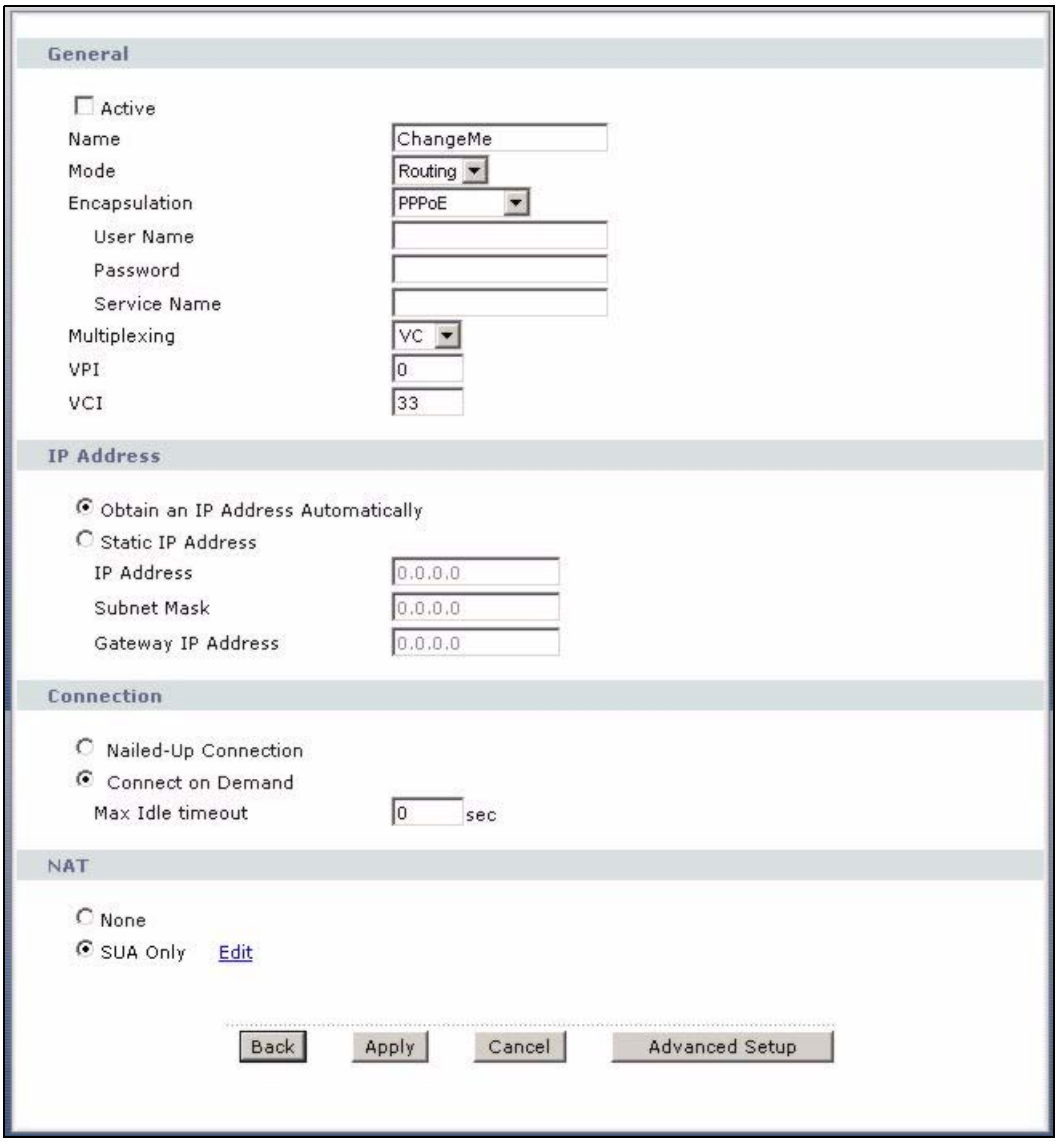
Table 35 More Connections

LABEL	DESCRIPTION
#	This is the index number of a connection.
Active	This display whether this connection is activated. Clear the check box to disable the connection. Select the check box to enable it.
Name	This is the descriptive name for this connection.
VPI/VCI	This is the VPI and VCI values used for this connection.
Encapsulation	This is the method of encapsulation used for this connection.
Modify	The first (ISP) connection is read-only in this screen. Use the **WAN > Internet Connection** screen to edit it. Click the edit icon to go to the screen where you can edit the connection. Click the delete icon to remove an existing connection. You cannot remove the first connection.
Apply	Click **Apply** to save the changes.
Cancel	Click **Cancel** to begin configuring this screen afresh.

7.6.1 More Connections Edit

Click the edit icon in the **More Connections** screen to configure a connection.

Figure 70 More Connections Edit



The following table describes the labels in this screen.

Table 36 More Connections Edit

LABEL	DESCRIPTION
Active	Select the check box to activate or clear the check box to deactivate this connection.
Name	Enter a unique, descriptive name of up to 13 ASCII characters for this connection.
Mode	Select **Routing** from the drop-down list box if your ISP allows multiple computers to share an Internet account. If you select **Bridge**, the ZyXEL Device will forward any packet that does not route to this remote node; otherwise, the packets are discarded.
Encapsulation	Select the method of encapsulation used by your ISP from the drop-down list box. Choices are **PPPoA**, **RFC 1483**, **ENET ENCAP** or **PPPoE**.

Table 36 More Connections Edit (continued)

LABEL	DESCRIPTION
User Name	(PPPoA and PPPoE encapsulation only) Enter the user name exactly as your ISP assigned. If assigned a name in the form user@domain where domain identifies a service name, then enter both components exactly as given.
Password	(PPPoA and PPPoE encapsulation only) Enter the password associated with the user name above.
Service Name	(PPPoE only) Type the name of your PPPoE service here.
Multiplexing	Select the method of multiplexing used by your ISP from the drop-down list. Choices are **VC** or **LLC**. By prior agreement, a protocol is assigned a specific virtual circuit, for example, VC1 will carry IP. If you select VC, specify separate VPI and VCI numbers for each protocol. For LLC-based multiplexing or PPP encapsulation, one VC carries multiple protocols with protocol identifying information being contained in each packet header. In this case, only one set of VPI and VCI numbers need be specified for all protocols.
VPI	The valid range for the VPI is 0 to 255. Enter the VPI assigned to you.
VCI	The valid range for the VCI is 32 to 65535 (0 to 31 is reserved for local management of ATM traffic). Enter the VCI assigned to you.
IP Address	This option is available if you select **Routing** in the **Mode** field. A static IP address is a fixed IP that your ISP gives you. A dynamic IP address is not fixed; the ISP assigns you a different one each time you connect to the Internet. If you use the encapsulation type except **RFC 1483**, select **Obtain an IP Address Automatically** when you have a dynamic IP address; otherwise select **Static IP Address** and type your ISP assigned IP address in the **IP Address** field below. If you use **RFC 1483**, enter the IP address given by your ISP in the **IP Address** field.
Subnet Mask	Enter a subnet mask in dotted decimal notation. Refer to the appendices to calculate a subnet mask If you are implementing subnetting.
Gateway IP address	Specify a gateway IP address (supplied by your ISP).
Connection	
Nailed-Up Connection	Select **Nailed-Up Connection** when you want your connection up all the time. The ZyXEL Device will try to bring up the connection automatically if it is disconnected.
Connect on Demand	Select **Connect on Demand** when you don't want the connection up all the time and specify an idle time-out in the **Max Idle Timeout** field.
Max Idle Timeout	Specify an idle time-out in the **Max Idle Timeout** field when you select **Connect on Demand**. The default setting is 0, which means the Internet session will not timeout.
NAT	**SUA only** is available only when you select **Routing** in the **Mode** field. Select **SUA Only** if you have one public IP address and want to use NAT. Click **Edit** to go to the **Port Forwarding** screen to edit a server mapping set. Otherwise, select **None** to disable NAT.
Back	Click **Back** to return to the previous screen.
Apply	Click **Apply** to save the changes.

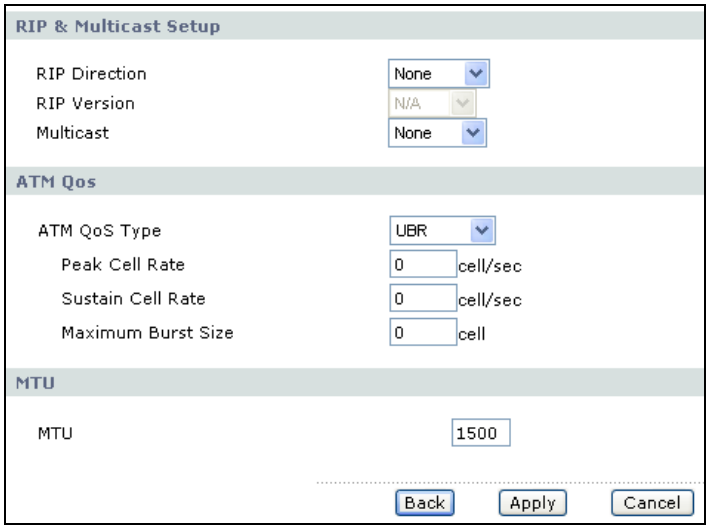
Table 36 More Connections Edit (continued)

LABEL	DESCRIPTION
Cancel	Click **Cancel** to begin configuring this screen afresh.
Advanced Setup	Click this button to display the **More Connections Advanced** screen and edit more details of your WAN setup.

7.6.2 Configuring More Connections Advanced Setup

To edit your ZyXEL Device's advanced WAN settings, click the **Advanced Setup** button in the **More Connections Edit** screen. The screen appears as shown.

Figure 71 More Connections Advanced Setup



The following table describes the labels in this screen.

Table 37 More Connections Advanced Setup

LABEL	DESCRIPTION
RIP & Multicast Setup	
RIP Direction	Select the RIP direction from **None**, **Both**, **In Only** and **Out Only**.
RIP Version	Select the RIP version from **RIP-1**, **RIP-2B** and **RIP-2M**.
Multicast	IGMP (Internet Group Multicast Protocol) is a network-layer protocol used to establish membership in a multicast group. The ZyXEL Device supports both IGMP version 1 (**IGMP-v1**) and **IGMP-v2**. Select **None** to disable it.
ATM QoS	
ATM QoS Type	Select **CBR** (Continuous Bit Rate) to specify fixed (always-on) bandwidth for voice or data traffic. Select **UBR** (Unspecified Bit Rate) for applications that are non-time sensitive, such as e-mail. Select **VBR-nRT** (Variable Bit Rate-non Real Time) or **VBR-RT** (Variable Bit Rate-Real Time) for bursty traffic and bandwidth sharing with other applications.
Peak Cell Rate	Divide the DSL line rate (bps) by 424 (the size of an ATM cell) to find the Peak Cell Rate (PCR). This is the maximum rate at which the sender can send cells. Type the PCR here.

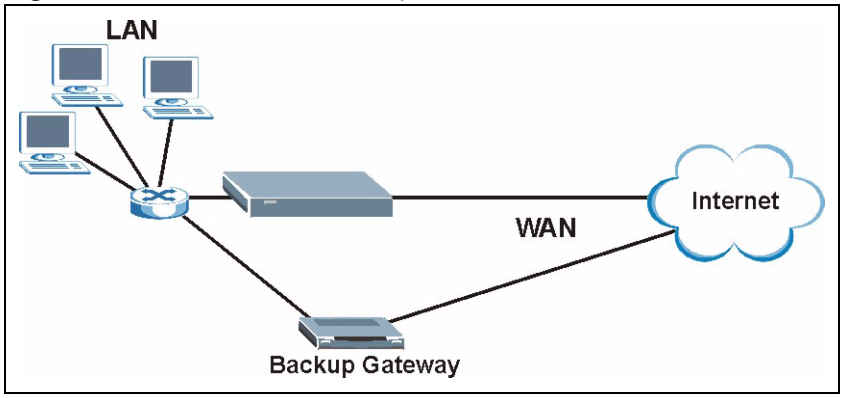
Table 37 More Connections Advanced Setup (continued)

LABEL	DESCRIPTION
Sustain Cell Rate	The Sustain Cell Rate (SCR) sets the average cell rate (long-term) that can be transmitted. Type the SCR, which must be less than the PCR. Note that system default is 0 cells/sec.
Maximum Burst Size	Maximum Burst Size (MBS) refers to the maximum number of cells that can be sent at the peak rate. Type the MBS, which is less than 65535.
MTU	
MTU	The Maximum Transmission Unit (MTU) defines the size of the largest packet allowed on an interface or connection. Enter the MTU in this field. For ENET ENCAP, the MTU value is 1500. For PPPoE, the MTU value is 1492. For PPPoA and RFC 1483, the MTU is 65535.
Back	Click **Back** to return to the previous screen.
Apply	Click **Apply** to save the changes.
Cancel	Click **Cancel** to begin configuring this screen afresh.

7.7 Traffic Redirect

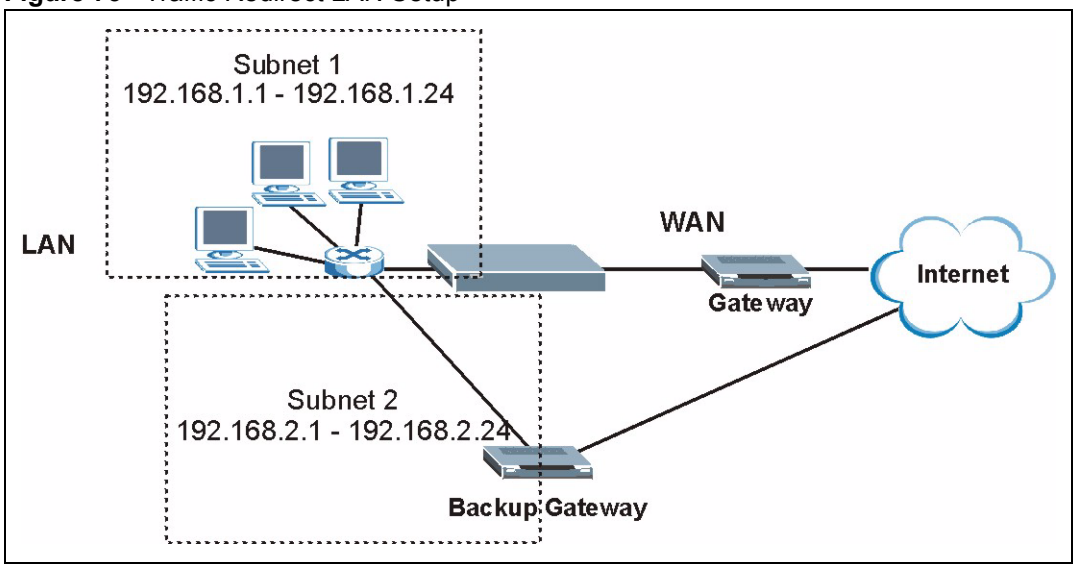
Traffic redirect forwards traffic to a backup gateway when the ZyXEL Device cannot connect to the Internet. An example is shown in the figure below.

Figure 72 Traffic Redirect Example



The following network topology allows you to avoid triangle route security issues when the backup gateway is connected to the LAN. Use IP alias to configure the LAN into two or three logical networks with the ZyXEL Device itself as the gateway for each LAN network. Put the protected LAN in one subnet (Subnet 1 in the following figure) and the backup gateway in another subnet (Subnet 2). Configure filters that allow packets from the protected LAN (Subnet 1) to the backup gateway (Subnet 2).

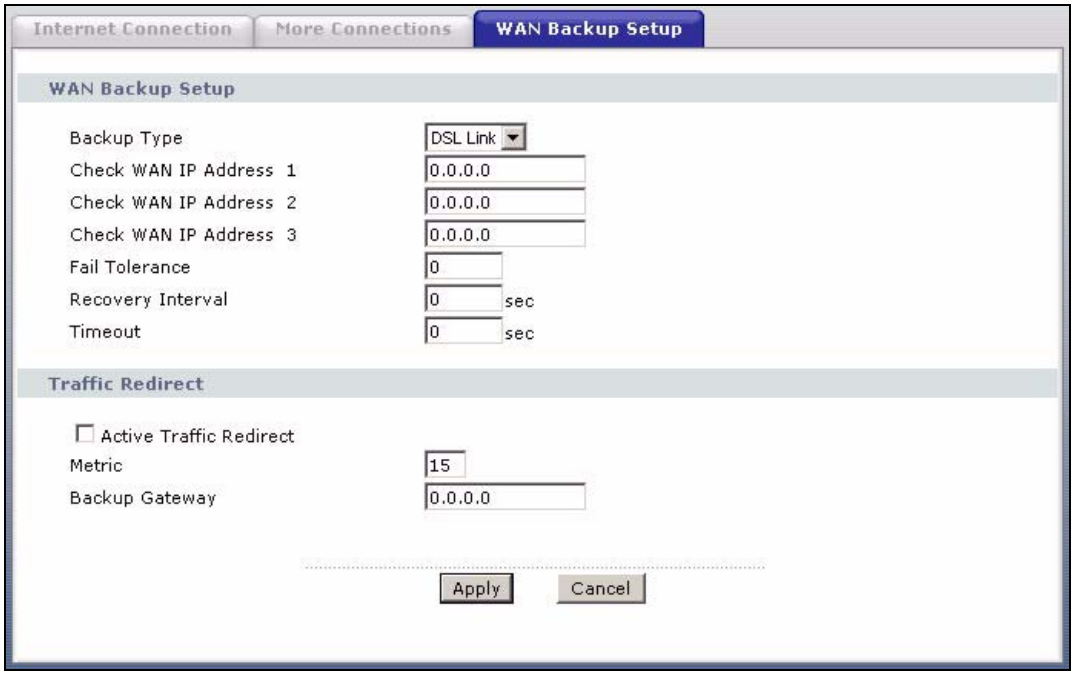
Figure 73 Traffic Redirect LAN Setup



7.8 Configuring WAN Backup

To change your ZyXEL Device's WAN backup settings, click **Network > WAN** > **WAN Backup Setup**. The screen appears as shown.

Figure 74 WAN Backup Setup



The following table describes the labels in this screen.

Table 38 WAN Backup Setup

LABEL	DESCRIPTION
Backup Type	Select the method that the ZyXEL Device uses to check the DSL connection. Select **DSL Link** to have the ZyXEL Device check if the connection to the DSLAM is up. Select **ICMP** to have the ZyXEL Device periodically ping the IP addresses configured in the **Check WAN IP Address** fields.
Check WAN IP Address1-3	Configure this field to test your ZyXEL Device's WAN accessibility. Type the IP address of a reliable nearby computer (for example, your ISP's DNS server address). Note: If you activate either traffic redirect or dial backup, you must configure at least one IP address here. When using a WAN backup connection, the ZyXEL Device periodically pings the addresses configured here and uses the other WAN backup connection (if configured) if there is no response.
Fail Tolerance	Type the number of times (2 recommended) that your ZyXEL Device may ping the IP addresses configured in the **Check WAN IP Address** field without getting a response before switching to a WAN backup connection (or a different WAN backup connection).
Recovery Interval	When the ZyXEL Device is using a lower priority connection (usually a WAN backup connection), it periodically checks to whether or not it can use a higher priority connection. Type the number of seconds (30 recommended) for the ZyXEL Device to wait between checks. Allow more time if your destination IP address handles lots of traffic.
Timeout	Type the number of seconds (3 recommended) for your ZyXEL Device to wait for a ping response from one of the IP addresses in the **Check WAN IP Address** field before timing out the request. The WAN connection is considered "down" after the ZyXEL Device times out the number of times specified in the **Fail Tolerance** field. Use a higher value in this field if your network is busy or congested.
Traffic Redirect	Traffic redirect forwards traffic to a backup gateway when the ZyXEL Device cannot connect to the Internet.
Active Traffic Redirect	Select this check box to have the ZyXEL Device use traffic redirect if the normal WAN connection goes down. Note: If you activate traffic redirect, you must configure at least one Check WAN IP Address.
Metric	This field sets this route's priority among the routes the ZyXEL Device uses. The metric represents the "cost of transmission". A router determines the best route for transmission by choosing a path with the lowest "cost". RIP routing uses hop count as the measurement of cost, with a minimum of "1" for directly connected networks. The number must be between "1" and "15"; a number greater than "15" means the link is down. The smaller the number, the lower the "cost".
Backup Gateway	Type the IP address of your backup gateway in dotted decimal notation. The ZyXEL Device automatically forwards traffic to this IP address if the ZyXEL Device's Internet connection terminates.
Apply	Click **Apply** to save the changes.
Cancel	Click **Cancel** to begin configuring this screen afresh.

8

LAN Setup

This chapter describes how to configure LAN settings.

8.1 LAN Overview

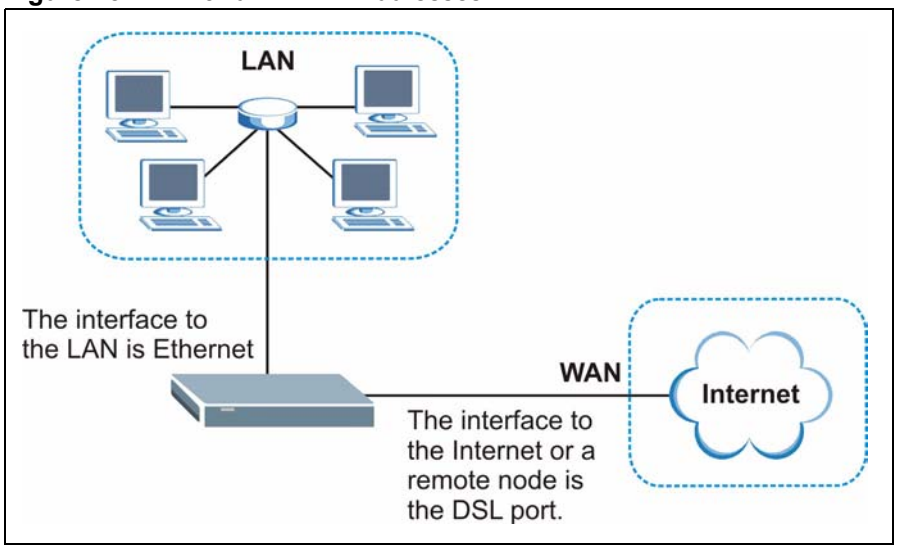
A Local Area Network (LAN) is a shared communication system to which many computers are attached. A LAN is a computer network limited to the immediate area, usually the same building or floor of a building. The LAN screens can help you configure a LAN DHCP server and manage IP addresses.

See Section 8.3 on page 120 to configure the **LAN** screens.

8.1.1 LANs, WANs and the ZyXEL Device

The actual physical connection determines whether the ZyXEL Device ports are LAN or WAN ports. There are two separate IP networks, one inside the LAN network and the other outside the WAN network as shown next.

Figure 75 LAN and WAN IP Addresses



8.1.2 DHCP Setup

DHCP (Dynamic Host Configuration Protocol, RFC 2131 and RFC 2132) allows individual clients to obtain TCP/IP configuration at start-up from a server. You can configure the ZyXEL Device as a DHCP server or disable it. When configured as a server, the ZyXEL Device provides the TCP/IP configuration for the clients. If you turn DHCP service off, you must have another DHCP server on your LAN, or else the computer must be manually configured.

8.1.2.1 IP Pool Setup

The ZyXEL Device is pre-configured with a pool of IP addresses for the DHCP clients (DHCP Pool). See the product specifications in the appendices. Do not assign static IP addresses from the DHCP pool to your LAN computers.

8.1.3 DNS Server Address

DNS (Domain Name System) is for mapping a domain name to its corresponding IP address and vice versa. The DNS server is extremely important because without it, you must know the IP address of a machine before you can access it. The DNS server addresses that you enter in the DHCP setup are passed to the client machines along with the assigned IP address and subnet mask.

There are two ways that an ISP disseminates the DNS server addresses. The first is for an ISP to tell a customer the DNS server addresses, usually in the form of an information sheet, when s/he signs up. If your ISP gives you the DNS server addresses, enter them in the **DNS Server** fields in **DHCP Setup**, otherwise, leave them blank.

Some ISP's choose to pass the DNS servers using the DNS server extensions of PPP IPCP (IP Control Protocol) after the connection is up. If your ISP did not give you explicit DNS servers, chances are the DNS servers are conveyed through IPCP negotiation. The ZyXEL Device supports the IPCP DNS server extensions through the DNS proxy feature.

If the **Primary** and **Secondary DNS Server** fields in the **DHCP Setup** screen are not specified, for instance, left as **0.0.0.0**, the ZyXEL Device tells the DHCP clients that it itself is the DNS server. When a computer sends a DNS query to the ZyXEL Device, the ZyXEL Device forwards the query to the real DNS server learned through IPCP and relays the response back to the computer.

Please note that DNS proxy works only when the ISP uses the IPCP DNS server extensions. It does not mean you can leave the DNS servers out of the DHCP setup under all circumstances. If your ISP gives you explicit DNS servers, make sure that you enter their IP addresses in the DHCP Setup screen. This way, the ZyXEL Device can pass the DNS servers to the computers and the computers can query the DNS server directly without the ZyXEL Device's intervention.

8.1.4 DNS Server Address Assignment

Use DNS (Domain Name System) to map a domain name to its corresponding IP address and vice versa. The DNS server is extremely important because without it, you must know the IP address of a computer before you can access it.

There are two ways that an ISP disseminates the DNS server addresses.

- The ISP tells you the DNS server addresses, usually in the form of an information sheet, when you sign up. If your ISP gives you DNS server addresses, enter them in the DNS Server fields in the **DHCP Setup** screen.
- The ZyXEL Device acts as a DNS proxy when the **Primary** and **Secondary DNS Server** fields are left as **0.0.0.0** in the **DHCP Setup** screen.

8.2 LAN TCP/IP

The ZyXEL Device has built-in DHCP server capability that assigns IP addresses and DNS servers to systems that support DHCP client capability.

8.2.1 IP Address and Subnet Mask

Similar to the way houses on a street share a common street name, so too do computers on a LAN share one common network number.

Where you obtain your network number depends on your particular situation. If the ISP or your network administrator assigns you a block of registered IP addresses, follow their instructions in selecting the IP addresses and the subnet mask.

If the ISP did not explicitly give you an IP network number, then most likely you have a single user account and the ISP will assign you a dynamic IP address when the connection is established. If this is the case, it is recommended that you select a network number from 192.168.0.0 to 192.168.255.0 and you must enable the Network Address Translation (NAT) feature of the ZyXEL Device. The Internet Assigned Number Authority (IANA) reserved this block of addresses specifically for private use; please do not use any other number unless you are told otherwise. Let's say you select 192.168.1.0 as the network number; which covers 254 individual addresses, from 192.168.1.1 to 192.168.1.254 (zero and 255 are reserved). In other words, the first three numbers specify the network number while the last number identifies an individual computer on that network.

Once you have decided on the network number, pick an IP address that is easy to remember, for instance, 192.168.1.1, for your ZyXEL Device, but make sure that no other device on your network is using that IP address.

The subnet mask specifies the network number portion of an IP address. Your ZyXEL Device will compute the subnet mask automatically based on the IP address that you entered. You don't need to change the subnet mask computed by the ZyXEL Device unless you are instructed to do otherwise.

8.2.1.1 Private IP Addresses

Every machine on the Internet must have a unique address. If your networks are isolated from the Internet, for example, only between your two branch offices, you can assign any IP addresses to the hosts without problems. However, the Internet Assigned Numbers Authority (IANA) has reserved the following three blocks of IP addresses specifically for private networks:

- 10.0.0.0 — 10.255.255.255
- 172.16.0.0 — 172.31.255.255
- 192.168.0.0 — 192.168.255.255

You can obtain your IP address from the IANA, from an ISP or it can be assigned from a private network. If you belong to a small organization and your Internet access is through an ISP, the ISP can provide you with the Internet addresses for your local networks. On the other hand, if you are part of a much larger organization, you should consult your network administrator for the appropriate IP addresses.

Regardless of your particular situation, do not create an arbitrary IP address; always follow the guidelines above. For more information on address assignment, please refer to RFC 1597, *Address Allocation for Private Internets* and RFC 1466, *Guidelines for Management of IP Address Space.*

8.2.2 RIP Setup

RIP (Routing Information Protocol) allows a router to exchange routing information with other routers. The **RIP Direction** field controls the sending and receiving of RIP packets. When set to:

- **Both** - the ZyXEL Device will broadcast its routing table periodically and incorporate the RIP information that it receives.
- **In Only** - the ZyXEL Device will not send any RIP packets but will accept all RIP packets received.
- **Out Only** - the ZyXEL Device will send out RIP packets but will not accept any RIP packets received.
- **None** - the ZyXEL Device will not send any RIP packets and will ignore any RIP packets received.

The **Version** field controls the format and the broadcasting method of the RIP packets that the ZyXEL Device sends (it recognizes both formats when receiving). **RIP-1** is universally supported; but RIP-2 carries more information. RIP-1 is probably adequate for most networks, unless you have an unusual network topology.

Both **RIP-2B** and **RIP-2M** sends the routing data in RIP-2 format; the difference being that **RIP-2B** uses subnet broadcasting while **RIP-2M** uses multicasting.

8.2.3 Multicast

Traditionally, IP packets are transmitted in one of either two ways - Unicast (1 sender - 1 recipient) or Broadcast (1 sender - everybody on the network). Multicast delivers IP packets to a group of hosts on the network - not everybody and not just 1.

IGMP (Internet Group Management Protocol) is a network-layer protocol used to establish membership in a Multicast group - it is not used to carry user data. IGMP version 2 (RFC 2236) is an improvement over version 1 (RFC 1112) but IGMP version 1 is still in wide use. If you would like to read more detailed information about interoperability between IGMP version 2 and version 1, please see sections 4 and 5 of RFC 2236. The class D IP address is used to identify host groups and can be in the range 224.0.0.0 to 239.255.255.255. The address

224.0.0.0 is not assigned to any group and is used by IP multicast computers. The address 224.0.0.1 is used for query messages and is assigned to the permanent group of all IP hosts (including gateways). All hosts must join the 224.0.0.1 group in order to participate in IGMP. The address 224.0.0.2 is assigned to the multicast routers group.

The ZyXEL Device supports both IGMP version 1 (**IGMP-v1**) and IGMP version 2 (**IGMP-v2**). At start up, the ZyXEL Device queries all directly connected networks to gather group membership. After that, the ZyXEL Device periodically updates this information. IP multicasting can be enabled/disabled on the ZyXEL Device LAN and/or WAN interfaces in the web configurator (**LAN**; **WAN**). Select **None** to disable IP multicasting on these interfaces.

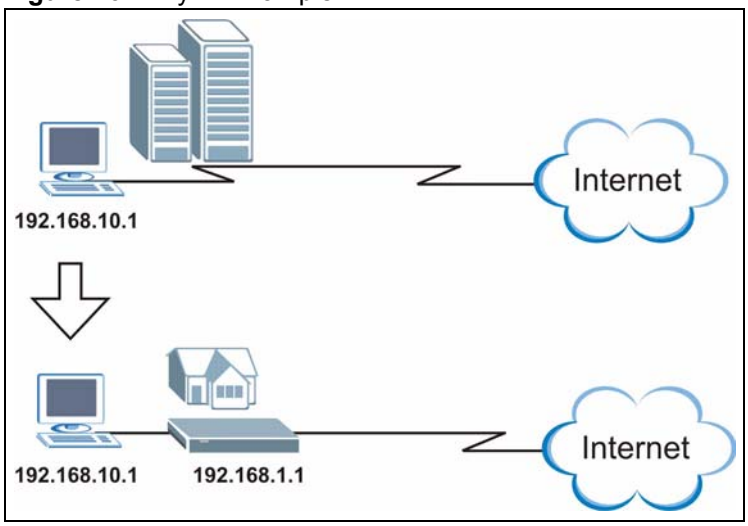
8.2.4 Any IP

Traditionally, you must set the IP addresses and the subnet masks of a computer and the ZyXEL Device to be in the same subnet to allow the computer to access the Internet (through the ZyXEL Device). In cases where your computer is required to use a static IP address in another network, you may need to manually configure the network settings of the computer every time you want to access the Internet via the ZyXEL Device.

With the Any IP feature and NAT enabled, the ZyXEL Device allows a computer to access the Internet without changing the network settings (such as IP address and subnet mask) of the computer, when the IP addresses of the computer and the ZyXEL Device are not in the same subnet. Whether a computer is set to use a dynamic or static (fixed) IP address, you can simply connect the computer to the ZyXEL Device and access the Internet.

The following figure depicts a scenario where a computer is set to use a static private IP address in the corporate environment. In a residential house where a ZyXEL Device is installed, you can still use the computer to access the Internet without changing the network settings, even when the IP addresses of the computer and the ZyXEL Device are not in the same subnet.

Figure 76 Any IP Example



The Any IP feature does not apply to a computer using either a dynamic IP address or a static IP address that is in the same subnet as the ZyXEL Device's IP address.

You *must* enable NAT/SUA to use the Any IP feature on the ZyXEL Device.

8.2.4.1 How Any IP Works

Address Resolution Protocol (ARP) is a protocol for mapping an Internet Protocol address (IP address) to a physical machine address, also known as a Media Access Control or MAC address, on the local area network. IP routing table is defined on IP Ethernet devices (the ZyXEL Device) to decide which hop to use, to help forward data along to its specified destination.

The following lists out the steps taken, when a computer tries to access the Internet for the first time through the ZyXEL Device.

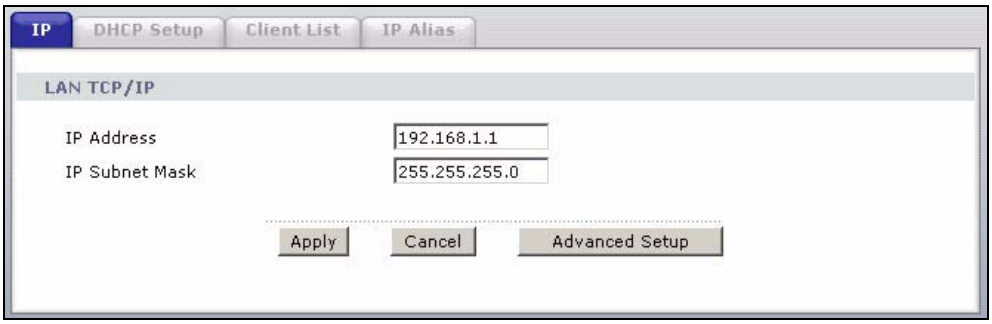
1. When a computer (which is in a different subnet) first attempts to access the Internet, it sends packets to its default gateway (which is not the ZyXEL Device) by looking at the MAC address in its ARP table.
2. When the computer cannot locate the default gateway, an ARP request is broadcast on the LAN.
3. The ZyXEL Device receives the ARP request and replies to the computer with its own MAC address.
4. The computer updates the MAC address for the default gateway to the ARP table. Once the ARP table is updated, the computer is able to access the Internet through the ZyXEL Device.
5. When the ZyXEL Device receives packets from the computer, it creates an entry in the IP routing table so it can properly forward packets intended for the computer.

After all the routing information is updated, the computer can access the ZyXEL Device and the Internet as if it is in the same subnet as the ZyXEL Device.

8.3 Configuring LAN IP

Click **Network** > **LAN** to open the **IP** screen. See Section 8.1 on page 115 for background information.

Figure 77 LAN IP



The following table describes the fields in this screen.

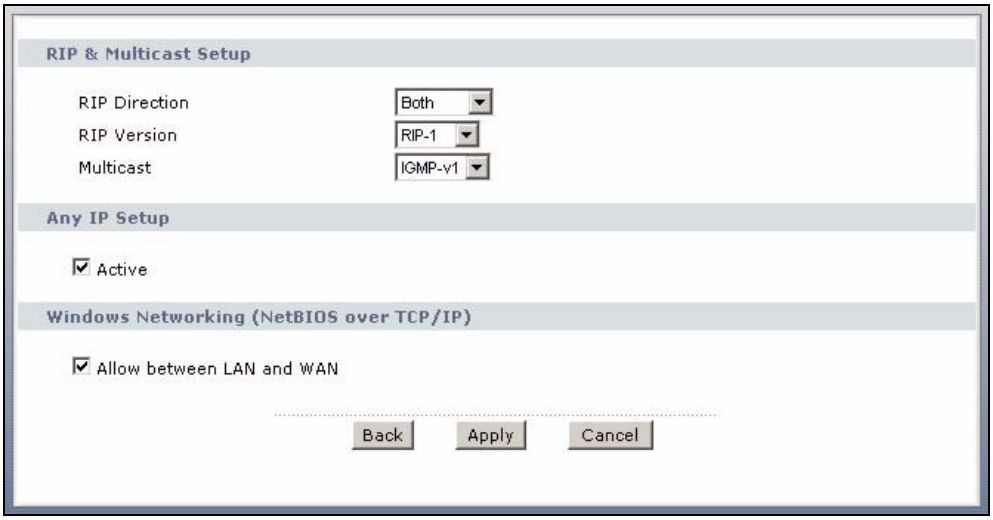
Table 39 LAN IP

LABEL	DESCRIPTION
TCP/IP	
IP Address	Enter the IP address of your ZyXEL Device in dotted decimal notation, for example, 192.168.1.1 (factory default).
IP Subnet Mask	Type the subnet mask assigned to you by your ISP (if given).
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.
Advanced Setup	Click this button to display the **Advanced LAN Setup** screen and edit more details of your LAN setup.

8.3.1 Configuring Advanced LAN Setup

To edit your ZyXEL Device's advanced LAN settings, click the **Advanced Setup** button in the **LAN IP** screen. The screen appears as shown.

Figure 78 Advanced LAN Setup



The following table describes the labels in this screen.

Table 40 Advanced LAN Setup

LABEL	DESCRIPTION
RIP & Multicast Setup	
RIP Direction	Select the RIP direction from **None**, **Both**, **In Only** and **Out Only**.
RIP Version	Select the RIP version from **RIP-1**, **RIP-2B** and **RIP-2M**.
Multicast	IGMP (Internet Group Management Protocol) is a network-layer protocol used to establish membership in a multicast group. The ZyXEL Device supports both IGMP version 1 (**IGMP-v1**) and **IGMP-v2**. Select **None** to disable it.

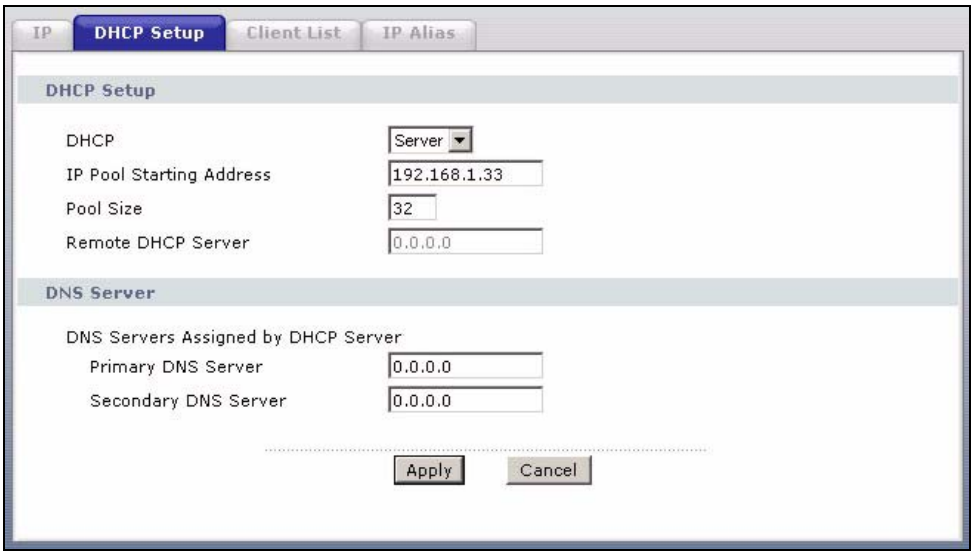
Table 40 Advanced LAN Setup (continued)

LABEL	DESCRIPTION
Any IP Setup	Select the **Active** check box to enable the Any IP feature. This allows a computer to access the Internet without changing the network settings (such as IP address and subnet mask) of the computer, even when the IP addresses of the computer and the ZyXEL Device are not in the same subnet. When you disable the Any IP feature, only computers with dynamic IP addresses or static IP addresses in the same subnet as the ZyXEL Device's LAN IP address can connect to the ZyXEL Device or access the Internet through the ZyXEL Device.
Windows Networking (NetBIOS over TCP/IP)	NetBIOS (Network Basic Input/Output System) are TCP or UDP packets that enable a computer to connect to and communicate with a LAN. For some dial-up services such as PPPoE or PPTP, NetBIOS packets cause unwanted calls. However it may sometimes be necessary to allow NetBIOS packets to pass through to the WAN in order to find a computer on the WAN.
Allow between LAN and WAN	Select this check box to forward NetBIOS packets from the LAN to the WAN and from the WAN to the LAN. If your firewall is enabled with the default policy set to block WAN to LAN traffic, you also need to enable the default WAN to LAN firewall rule that forwards NetBIOS traffic. Clear this check box to block all NetBIOS packets going from the LAN to the WAN and from the WAN to the LAN.
Back	Click **Back** to return to the previous screen.
Apply	Click **Apply** to save the changes.
Cancel	Click **Cancel** to begin configuring this screen afresh.

8.4 DHCP Setup

Use this screen to configure the DNS server information that the ZyXEL Device sends to the DHCP client devices on the LAN. Click **Network** > **LAN** > **DHCP Setup** to open the screen.

Figure 79 DHCP Setup



The following table describes the labels in this screen.

Table 41 DHCP Setup

LABEL	DESCRIPTION
DHCP Setup	
DHCP	If set to **Server**, your ZyXEL Device can assign IP addresses, an IP default gateway and DNS servers to Windows 95, Windows NT and other systems that support the DHCP client. If set to **None**, the DHCP server will be disabled. If set to **Relay**, the ZyXEL Device acts as a surrogate DHCP server and relays DHCP requests and responses between the remote server and the clients. Enter the IP address of the actual, remote DHCP server in the **Remote DHCP Server** field in this case. When DHCP is used, the following items need to be set:
IP Pool Starting Address	This field specifies the first of the contiguous addresses in the IP address pool.
Pool Size	This field specifies the size, or count of the IP address pool.
Remote DHCP Server	If **Relay** is selected in the **DHCP** field above then enter the IP address of the actual remote DHCP server here.
DNS Server	
DNS Servers Assigned by DHCP Server	The ZyXEL Device passes a DNS (Domain Name System) server IP address to the DHCP clients.
Primary DNS Server Secondary DNS Server	This field is not available when you set **DHCP** to **Relay**. Enter the IP addresses of the DNS servers. The DNS servers are passed to the DHCP clients along with the IP address and the subnet mask. If the fields are left as **0.0.0.0**, the ZyXEL Device acts as a DNS proxy and forwards the DHCP client's DNS query to the real DNS server learned through IPCP and relays the response back to the computer.
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.

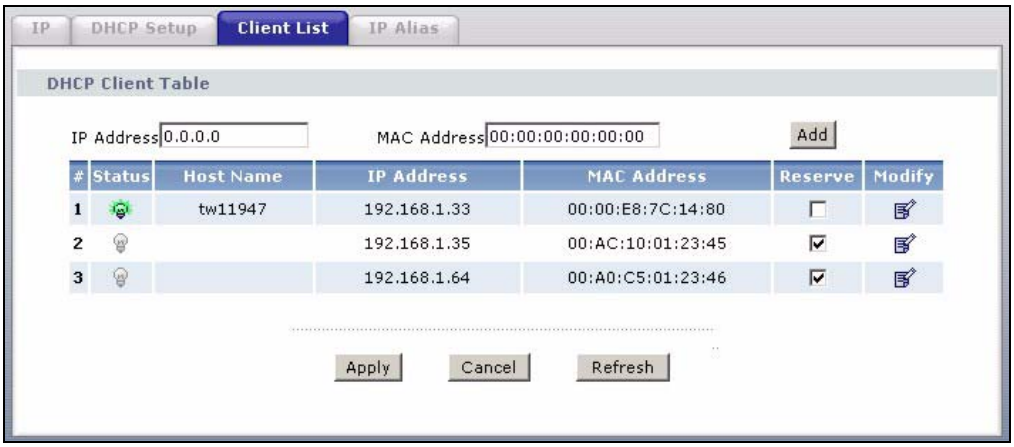
8.5 LAN Client List

This table allows you to assign IP addresses on the LAN to specific individual computers based on their MAC Addresses.

Every Ethernet device has a unique MAC (Media Access Control) address. The MAC address is assigned at the factory and consists of six pairs of hexadecimal characters, for example, 00:A0:C5:00:00:02.

To change your ZyXEL Device's static DHCP settings, click **Network > LAN > Client List**. The screen appears as shown.

Figure 80 LAN Client List



The following table describes the labels in this screen.

Table 42 LAN Client List

LABEL	DESCRIPTION
IP Address	Enter the IP address that you want to assign to the computer on your LAN with the MAC address specified below. The IP address should be within the range of IP addresses you specified in the **DHCP Setup** for the DHCP client.
MAC Address	Enter the MAC address of a computer on your LAN.
Add	Click **Add** to add a static DHCP entry.
#	This is the index number of the static IP table entry (row).
Status	This field displays whether the client is connected to the ZyXEL Device.
Host Name	This field displays the computer host name.
IP Address	This field displays the IP address relative to the # field listed above.
MAC Address	The MAC (Media Access Control) or Ethernet address on a LAN (Local Area Network) is unique to your computer (six pairs of hexadecimal notation). A network interface card such as an Ethernet adapter has a hardwired address that is assigned at the factory. This address follows an industry standard that ensures no other adapter has a similar address.
Reserve	Select the check box(es) in each entry to have the ZyXEL Device always assign the selected entry(ies)'s IP address(es) to the corresponding MAC address(es) (and host name(s)). You can select up to 32 entries in this table.
Modify	Click the modify icon to have the **IP address** field editable and change it.
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.
Refresh	Click **Refresh** to reload the DHCP table.

8.6 LAN IP Alias

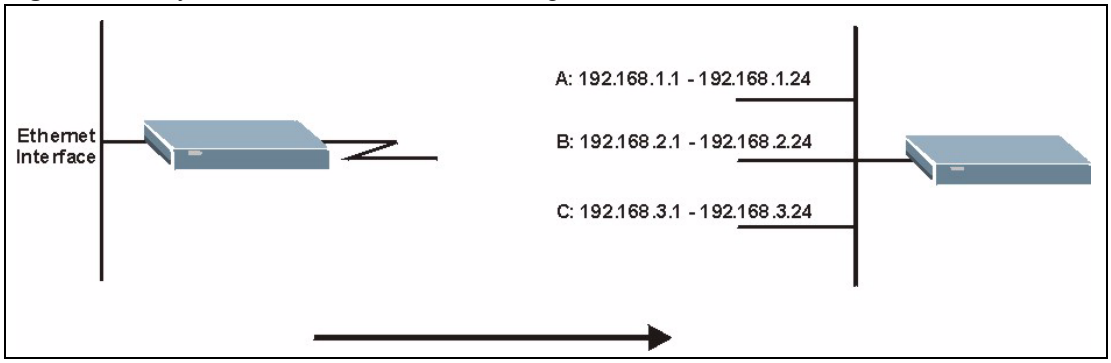
IP alias allows you to partition a physical network into different logical networks over the same Ethernet interface. The ZyXEL Device supports three logical LAN interfaces via its single physical Ethernet interface with the ZyXEL Device itself as the gateway for each LAN network.

When you use IP alias, you can also configure firewall rules to control access between the LAN's logical networks (subnets).

Make sure that the subnets of the logical networks do not overlap.

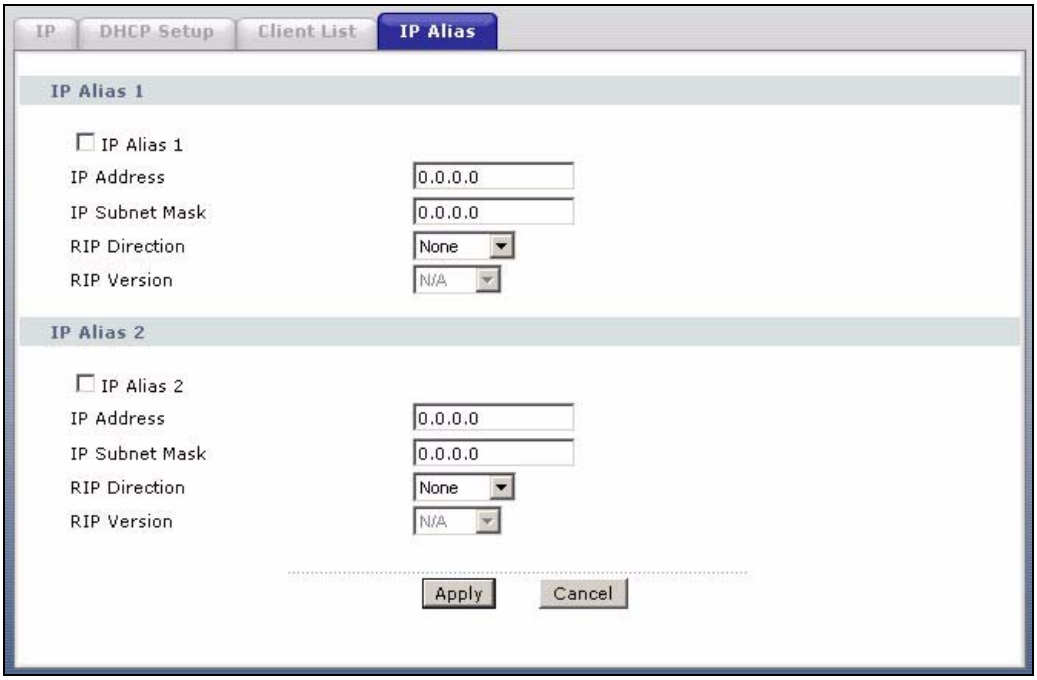
The following figure shows a LAN divided into subnets A, B, and C.

Figure 81 Physical Network & Partitioned Logical Networks



To change your ZyXEL Device's IP alias settings, click **Network** > **LAN** > **IP Alias**. The screen appears as shown.

Figure 82 LAN IP Alias



The following table describes the labels in this screen.

Table 43 LAN IP Alias

LABEL	DESCRIPTION
IP Alias 1, 2	Select the check box to configure another LAN network for the ZyXEL Device.
IP Address	Enter the IP address of your ZyXEL Device in dotted decimal notation. Alternatively, click the right mouse button to copy and/or paste the IP address.
IP Subnet Mask	Your ZyXEL Device will automatically calculate the subnet mask based on the IP address that you assign. Unless you are implementing subnetting, use the subnet mask computed by the ZyXEL Device.
RIP Direction	RIP (Routing Information Protocol, RFC 1058 and RFC 1389) allows a router to exchange routing information with other routers. The **RIP Direction** field controls the sending and receiving of RIP packets. Select the RIP direction from **Both**/**In Only**/**Out Only**/**None**. When set to **Both** or **Out Only**, the ZyXEL Device will broadcast its routing table periodically. When set to **Both** or **In Only**, it will incorporate the RIP information that it receives; when set to **None**, it will not send any RIP packets and will ignore any RIP packets received.
RIP Version	The **RIP Version** field controls the format and the broadcasting method of the RIP packets that the ZyXEL Device sends (it recognizes both formats when receiving). **RIP-1** is universally supported but RIP-2 carries more information. RIP-1 is probably adequate for most networks, unless you have an unusual network topology. Both **RIP-2B** and **RIP-2M** sends the routing data in RIP-2 format; the difference being that **RIP-2B** uses subnet broadcasting while **RIP-2M** uses multicasting. Multicasting can reduce the load on non-router machines since they generally do not listen to the RIP multicast address and so will not receive the RIP packets. However, if one router uses multicasting, then all routers on your network must use multicasting, also. By default, RIP direction is set to **Both** and the Version set to **RIP-1**.
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.

9

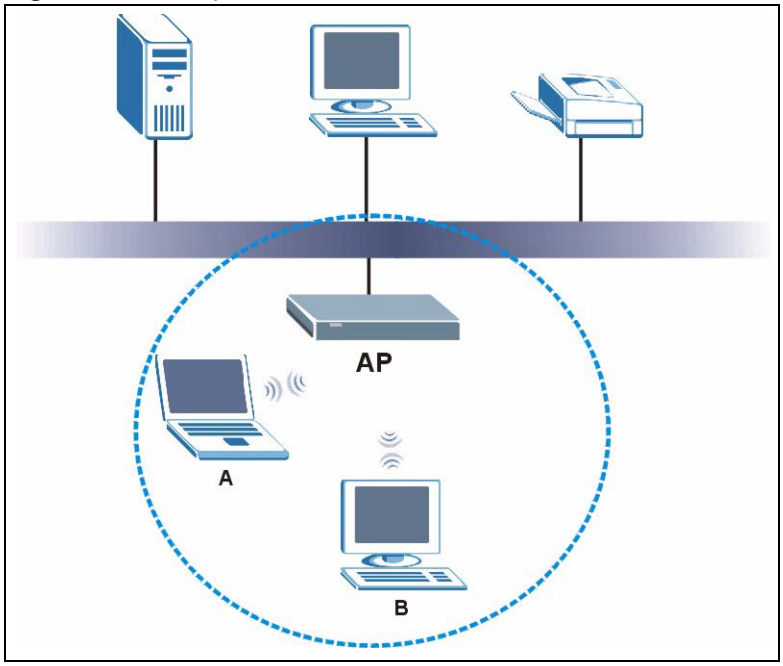
Wireless LAN

This chapter discusses how to configure the wireless network settings in your ZyXEL Device. See the appendices for more detailed information about wireless networks.

9.1 Wireless Network Overview

The following figure provides an example of a wireless network.

Figure 83 Example of a Wireless Network



The wireless network is the part in the blue circle. In this wireless network, devices A and B are called wireless clients. The wireless clients use the access point (AP) to interact with other devices (such as the printer) or with the Internet. Your ZyXEL Device is the AP.

Every wireless network must follow these basic guidelines.

- Every wireless client in the same wireless network must use the same SSID.
  The SSID is the name of the wireless network. It stands for Service Set IDentity.
- If two wireless networks overlap, they should use different channels.
  Like radio stations or television channels, each wireless network uses a specific channel, or frequency, to send and receive information.

- Every wireless client in the same wireless network must use security compatible with the AP.

  Security stops unauthorized devices from using the wireless network. It can also protect the information that is sent in the wireless network.

9.2 Wireless Security Overview

The following sections introduce different types of wireless security you can set up in the wireless network.

9.2.1 SSID

Normally, the AP acts like a beacon and regularly broadcasts the SSID in the area. You can hide the SSID instead, in which case the AP does not broadcast the SSID. In addition, you should change the default SSID to something that is difficult to guess.

This type of security is fairly weak, however, because there are ways for unauthorized devices to get the SSID. In addition, unauthorized devices can still see the information that is sent in the wireless network.

9.2.2 MAC Address Filter

Every wireless client has a unique identification number, called a MAC address.[1] A MAC address is usually written using twelve hexadecimal characters[2]; for example, 00A0C5000002 or 00:A0:C5:00:00:02. To get the MAC address for each wireless client, see the appropriate User's Guide or other documentation.

You can use the MAC address filter to tell the AP which wireless clients are allowed or not allowed to use the wireless network. If a wireless client is allowed to use the wireless network, it still has to have the correct settings (SSID, channel, and security). If a wireless client is not allowed to use the wireless network, it does not matter if it has the correct settings.

This type of security does not protect the information that is sent in the wireless network. Furthermore, there are ways for unauthorized devices to get the MAC address of an authorized wireless client. Then, they can use that MAC address to use the wireless network.

9.2.3 User Authentication

Authentication is the process of verifying whether a wireless device is allowed to use the wireless network. You can make every user log in to the wireless network before they can use it. This is called user authentication. However, every wireless client in the wireless network has to support IEEE 802.1x to do this.

For wireless networks, there are two typical places to store the user names and passwords for each user.

- In the AP: this feature is called a local user database or a local database.

1. Some wireless devices, such as scanners, can detect wireless networks but cannot use wireless networks. These kinds of wireless devices might not have MAC addresses.
2. Hexadecimal characters are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, and F.

- In a RADIUS server: this is a server used in businesses more than in homes.

If your AP does not provide a local user database and if you do not have a RADIUS server, you cannot set up user names and passwords for your users.

Unauthorized devices can still see the information that is sent in the wireless network, even if they cannot use the wireless network. Furthermore, there are ways for unauthorized wireless users to get a valid user name and password. Then, they can use that user name and password to use the wireless network.

Local user databases also have an additional limitation that is explained in the next section.

9.2.4 Encryption

Wireless networks can use encryption to protect the information that is sent in the wireless network. Encryption is like a secret code. If you do not know the secret code, you cannot understand the message.

The types of encryption you can choose depend on the type of user authentication. (See Section 9.2.3 on page 128 for information about this.)

Table 44 Types of Encryption for Each Type of Authentication

	NO AUTHENTICATION	RADIUS SERVER
Weakest	No Security	WPA
↕	Static WEP	
	WPA-PSK	
Strongest	WPA2-PSK	WPA2

For example, if the wireless network has a RADIUS server, you can choose **WPA** or **WPA2**. If users do not log in to the wireless network, you can choose no encryption, **Static WEP**, **WPA-PSK**, or **WPA2-PSK**.

Usually, you should set up the strongest encryption that every wireless client in the wireless network supports. For example, suppose the AP does not have a local user database, and you do not have a RADIUS server. Therefore, there is no user authentication. Suppose the wireless network has two wireless clients. Device A only supports WEP, and device B supports WEP and WPA. Therefore, you should set up **Static WEP** in the wireless network.

It is recommended that wireless networks use **WPA-PSK**, **WPA**, or stronger encryption. IEEE 802.1x and WEP encryption are better than none at all, but it is still possible for unauthorized devices to figure out the original information pretty quickly.

It is not possible to use **WPA-PSK**, **WPA** or stronger encryption with a local user database. In this case, it is better to set up stronger encryption with no authentication than to set up weaker encryption with the local user database.

When you select **WPA2** or **WPA2-PSK** in your ZyXEL Device, you can also select an option (**WPA compatible**) to support WPA as well. In this case, if some wireless clients support WPA and some support WPA2, you should set up **WPA2-PSK** or **WPA2** (depending on the type of wireless network login) and select the **WPA compatible** option in the ZyXEL Device.

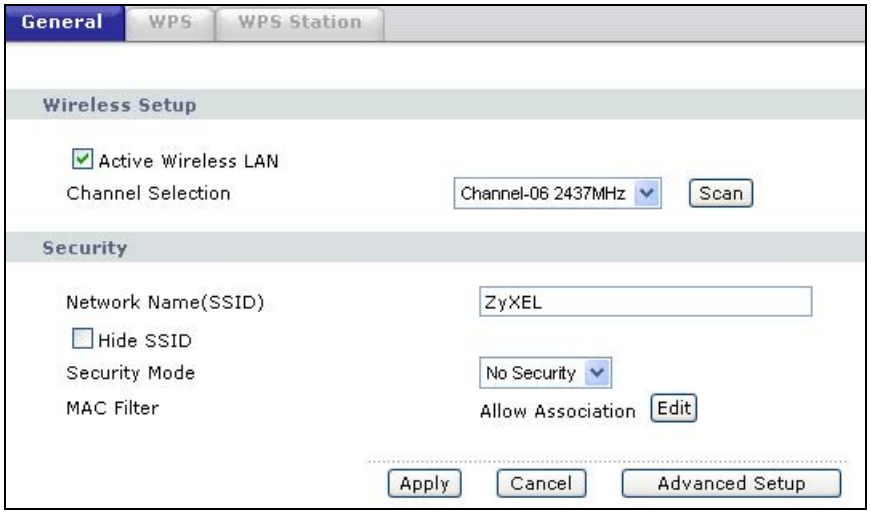
Many types of encryption use a key to protect the information in the wireless network. The longer the key, the stronger the encryption. Every wireless client in the wireless network must have the same key.

9.3 General Wireless LAN Screen

If you are configuring the ZyXEL Device from a computer connected to the wireless LAN and you change the ZyXEL Device's SSID or WEP settings, you will lose your wireless connection when you press **Apply** to confirm. You must then change the wireless settings of your computer to match the ZyXEL Device's new settings.

Click **Network > Wireless LAN** to open the **General** screen.

Figure 84 Wireless LAN: General



The following table describes the general wireless LAN labels in this screen.

Table 45 Wireless LAN: General

LABEL	DESCRIPTION
Wireless Setup	
Active Wireless LAN	Click the check box to activate wireless LAN.
Channel Selection	Set the operating frequency/channel depending on your particular region. Select a channel from the drop-down list box.
Security	

Table 45 Wireless LAN: General

LABEL	DESCRIPTION
Network Name (SSID)	(Service Set IDentity) The SSID identifies the Service Set with which a wireless client is associated. Wireless clients associating to the access point (AP) must have the same SSID. Enter a descriptive name (up to 32 printable 7-bit ASCII characters) for the wireless LAN. Note: If you are configuring the ZyXEL Device from a computer connected to the wireless LAN and you change the ZyXEL Device's SSID or WEP settings, you will lose your wireless connection when you press **Apply** to confirm. You must then change the wireless settings of your computer to match the ZyXEL Device's new settings.
Hide SSID	Select this check box to hide the SSID in the outgoing beacon frame so a station cannot obtain the SSID through scanning using a site survey tool.
Security Mode	See the following sections for more details about this feature.
MAC Filter	The MAC filter allows you to configure the ZyXEL Device to give exclusive access to up to 32 devices (Allow) or exclude up to 32 devices from accessing the ZyXEL Device (Deny). Every Ethernet device has a unique MAC (Media Access Control) address. The MAC address is assigned at the factory and consists of six pairs of hexadecimal characters, for example, 00:A0:C5:00:00:02. You need to know the MAC address of the devices to configure this screen. Click the **Edit** icon to configure the MAC filter. See Section 9.3.6 on page 138 for more details.
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Cancel	Click **Cancel** to reload the previous configuration for this screen.
Advanced Setup	Click **Advanced Setup** to display the **Wireless Advanced Setup** screen and edit more details of your WLAN setup. See Section 9.3.5 on page 137 for more details.

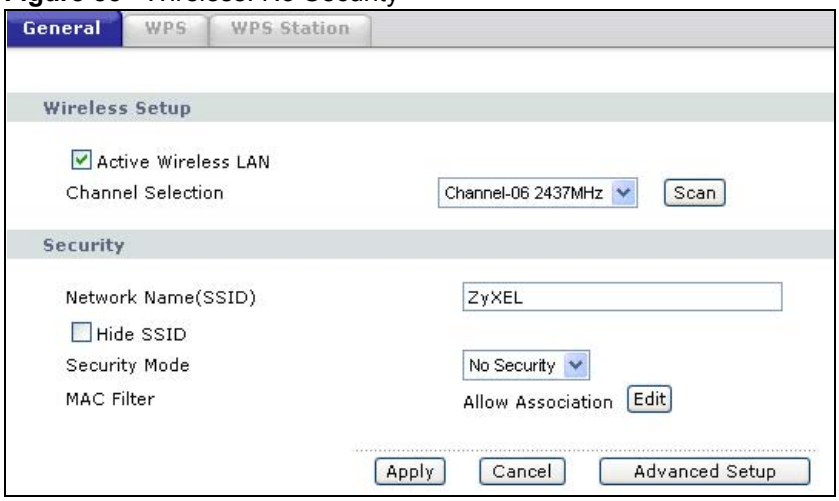
See the rest of this chapter for information on the other labels in this screen.

9.3.1 No Security

Select **No Security** to allow wireless clients to communicate with the access points without any data encryption.

If you do not enable any wireless security on your ZyXEL Device, your network is accessible to any wireless networking device that is within range.

Figure 85 Wireless: No Security



The following table describes the labels in this screen.

Table 46 Wireless No Security

LABEL	DESCRIPTION
Security Mode	Choose **No Security** from the drop-down list box.

9.3.2 WEP Encryption

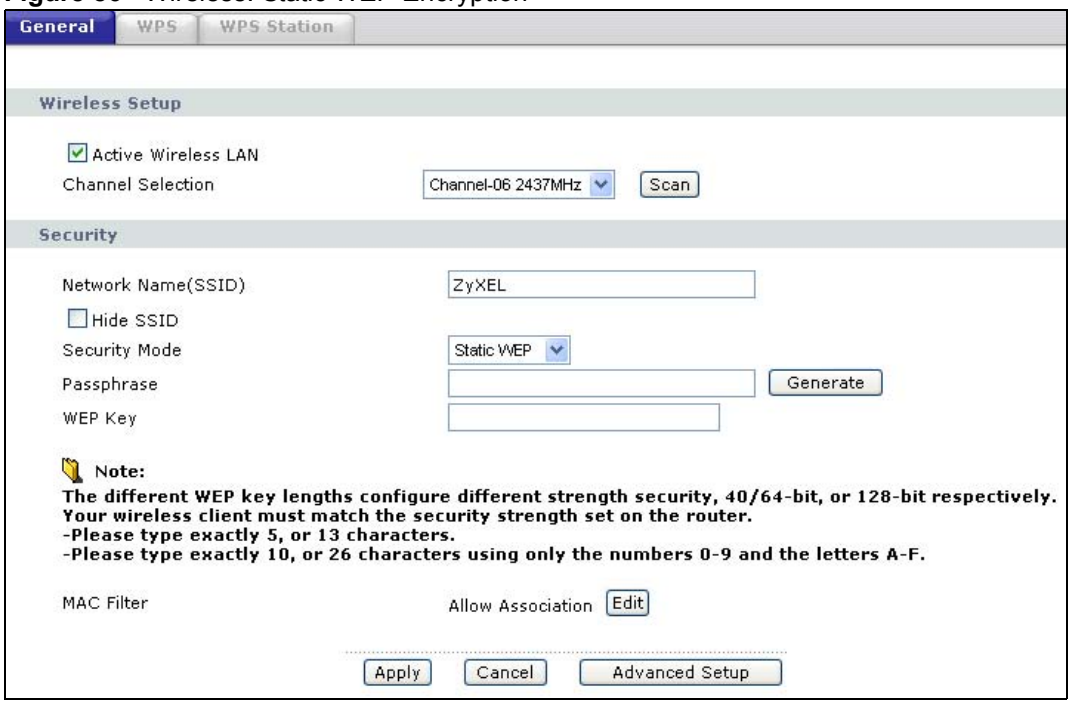
WEP encryption scrambles the data transmitted between the wireless clients and the access points to keep network communications private. It encrypts unicast and multicast communications in a network. Both the wireless clients and the access points must use the same WEP key.

Your ZyXEL Device allows you to configure up to four 64-bit, 128-bit or 256-bit WEP keys but only one key can be enabled at any one time.

WEP is extremely insecure. Its encryption can be broken by an attacker, using widely-available software. It is strongly recommended that you use a more effective security mechanism. Use the strongest security mechanism that all the wireless devices in your network support. For example, use WPA-PSK or WPA2-PSK if all your wireless devices support it, or use WPA or WPA2 if your wireless devices support it and you have a RADIUS server. If your wireless devices support nothing stronger than WEP, use the highest encryption level available.

In order to configure and enable WEP encryption; click **Network > Wireless LAN** to display the **General** screen. Select **Static WEP** from the **Security Mode** list.

Figure 86 Wireless: Static WEP Encryption



The following table describes the wireless LAN security labels in this screen.

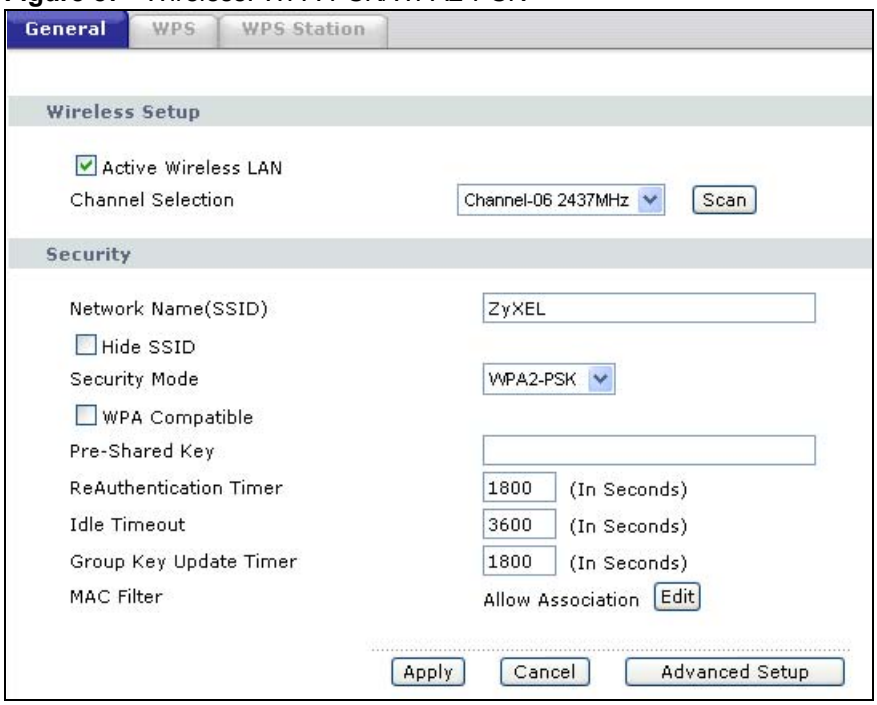
Table 47 Wireless: Static WEP Encryption

LABEL	DESCRIPTION
Security Mode	Choose **Static WEP** from the drop-down list box.
Passphrase	Enter a Passphrase (up to 32 printable characters) and clicking **Generate**. The ZyXEL Device automatically generates a WEP key.
WEP Key	The WEP keys are used to encrypt data. Both the ZyXEL Device and the wireless clients must use the same WEP key for data transmission. If you want to manually set the WEP key, enter any 5 or 13 characters (ASCII string) or 10 or 26 hexadecimal characters ("0-9", "A-F") for a 64-bit or 128-bit WEP key respectively.

9.3.3 WPA-PSK/WPA2-PSK

In order to configure and enable WPA(2)-PSK authentication; click **Network > Wireless LAN** to display the **General** screen. Select **WPA-PSK** or **WPA2-PSK** from the **Security Mode** list.

Figure 87 Wireless: WPA-PSK/WPA2-PSK



The following table describes the wireless LAN security labels in this screen.

Table 48 Wireless: WPA-PSK/WPA2-PSK

LABEL	DESCRIPTION
Security Mode	Choose **WPA-PSK** or **WPA2-PSK** from the drop-down list box.
WPA Compatible	This check box is available only when you select **WPA2-PSK** or **WPA2** in the **Security Mode** field. Select the check box to have both WPA2 and WPA wireless clients be able to communicate with the ZyXEL Device even when the ZyXEL Device is using WPA2-PSK or WPA2.
Pre-Shared Key	The encryption mechanisms used for **WPA/WPA2** and **WPA-PSK/WPA2-PSK** are the same. The only difference between the two is that **WPA-PSK/WPA2-PSK** uses a simple common password, instead of user-specific credentials. Type a pre-shared key from 8 to 63 case-sensitive ASCII characters (including spaces and symbols).
ReAuthentication Timer (In Seconds)	Specify how often wireless clients have to resend usernames and passwords in order to stay connected. Enter a time interval between 10 and 9999 seconds. The default time interval is 1800 seconds (30 minutes). Note: If wireless client authentication is done using a RADIUS server, the reauthentication timer on the RADIUS server has priority.

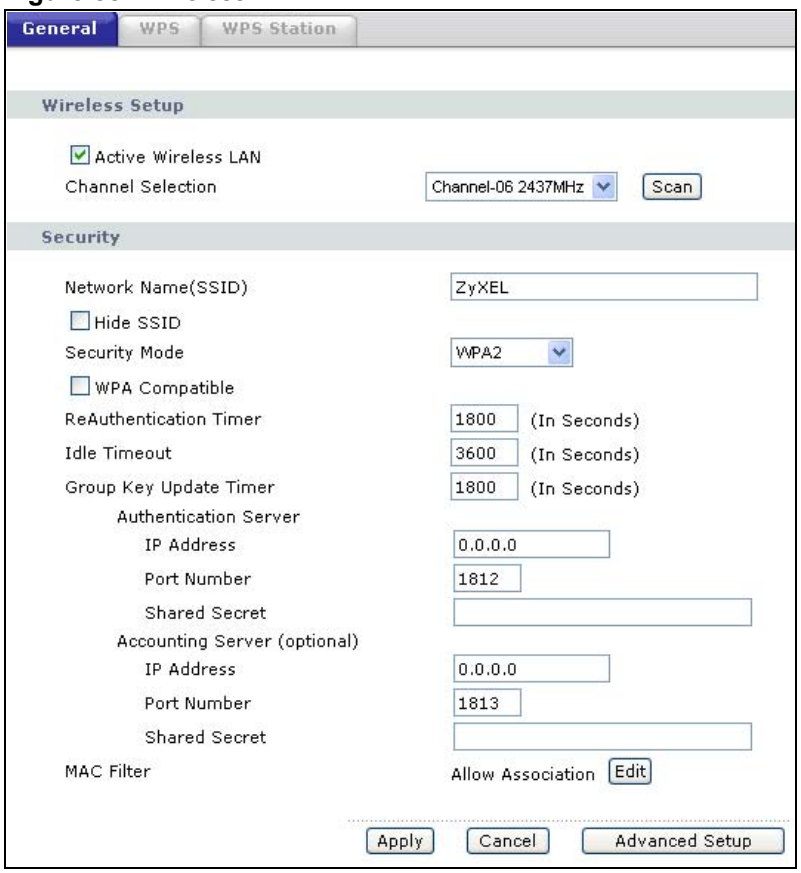
Table 48 Wireless: WPA-PSK/WPA2-PSK

LABEL	DESCRIPTION
Idle Timeout (In Seconds)	The ZyXEL Device automatically disconnects a wireless station from the wireless network after a period of inactivity. The wireless station needs to send the username and password again before it can use the wireless network again. Some wireless clients may prompt users for a username and password; other clients may use saved login credentials. In either case, there is usually a short delay while the wireless client logs in to the wireless network again. This value is usually smaller when the wireless network is keeping track of how much time each wireless station is connected to the wireless network (for example, using an authentication server). If the wireless network is not keeping track of this information, you can usually set this value higher to reduce the number of delays caused by logging in again.
Group Key Update Timer (In Seconds)	The **Group Key Update Timer** is the rate at which the AP (if using **WPA-PSK/ WPA2-PSK** key management) or RADIUS server (if using WPA(2) key management) sends a new group key out to all clients. The re-keying process is the WPA(2) equivalent of automatically changing the WEP key for an AP and all stations in a WLAN on a periodic basis. Setting of the **Group Key Update Timer** is also supported in **WPA-PSK/WPA2-PSK** mode. The default is **1800** seconds (30 minutes).

9.3.4 WPA/WPA2

In order to configure and enable WPA/WPA2; click the **Wireless LAN** link under **Network** to display the **General** screen. Select **WPA** or **WPA2** from the **Security Mode** list.

Figure 88 Wireless: WPA/WPA2



The following table describes the wireless LAN security labels in this screen.

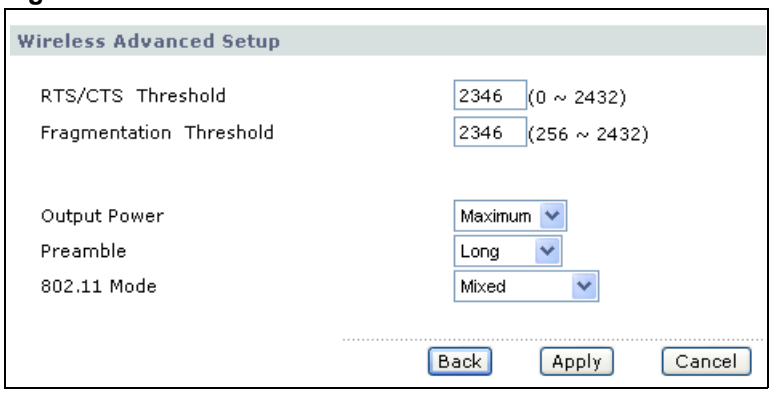
Table 49 Wireless: WPA/WPA2

LABEL	DESCRIPTION
WPA Compatible	This check box is available only when you select **WPA2-PSK** or **WPA2** in the **Security Mode** field. Select the check box to have both WPA2 and WPA wireless clients be able to communicate with the ZyXEL Device even when the ZyXEL Device is using WPA2-PSK or WPA2.
ReAuthentication Timer (In Seconds)	Specify how often wireless clients have to resend usernames and passwords in order to stay connected. Enter a time interval between 10 and 9999 seconds. The default time interval is 1800 seconds (30 minutes). Note: If wireless client authentication is done using a RADIUS server, the reauthentication timer on the RADIUS server has priority.
Idle Timeout (In Seconds)	The ZyXEL Device automatically disconnects a wireless client from the wired network after a period of inactivity. The wireless client needs to enter the username and password again before access to the wired network is allowed. The default time interval is 3600 seconds (or 1 hour).
Group Key Update Timer (In Seconds)	The **Group Key Update Timer** is the rate at which the AP (if using **WPA-PSK/ WPA2-PSK** key management) or **RADIUS** server (if using WPA(2) key management) sends a new group key out to all clients. The re-keying process is the WPA(2) equivalent of automatically changing the WEP key for an AP and all stations in a WLAN on a periodic basis. Setting of the **Group Key Update Timer** is also supported in **WPA-PSK/WPA2-PSK** mode. The default is **1800** seconds (30 minutes).
Authentication Server	
IP Address	Enter the IP address of the external authentication server in dotted decimal notation.
Port Number	Enter the port number of the external authentication server. The default port number is **1812**. You need not change this value unless your network administrator instructs you to do so with additional information.
Shared Secret	Enter a password (up to 31 alphanumeric characters) as the key to be shared between the external authentication server and the ZyXEL Device. The key must be the same on the external authentication server and your ZyXEL Device. The key is not sent over the network.
Accounting Server (optional)	
Active	Select **Yes** from the drop down list box to enable user accounting through an external authentication server.
IP Address	Enter the IP address of the external accounting server in dotted decimal notation.
Port Number	Enter the port number of the external accounting server. The default port number is **1813**. You need not change this value unless your network administrator instructs you to do so with additional information.
Shared Secret	Enter a password (up to 31 alphanumeric characters) as the key to be shared between the external accounting server and the ZyXEL Device. The key must be the same on the external accounting server and your ZyXEL Device. The key is not sent over the network.

9.3.5 Wireless LAN Advanced Setup

To configure advanced wireless settings, click the **Advanced Setup** button in the **General** screen. The screen appears as shown.

Figure 89 Advanced



The following table describes the labels in this screen.

Table 50 Wireless LAN: Advanced

LABEL	DESCRIPTION
Wireless Advanced Setup	
RTS/CTS Threshold	Use RTS/CTS to reduce data collisions on the wireless network if you have wireless clients that are associated with the same AP but out of range of one another. When enabled, a wireless client sends an RTS (Request To Send) and then waits for a CTS (Clear To Send) before it transmits. This stops wireless clients from transmitting packets at the same time (and causing data collisions). A wireless client sends an RTS for all packets larger than the number (of bytes) that you enter here. Set the RTS/CTS equal to or higher than the fragmentation threshold to turn RTS/CTS off. Enter a value between 0 and 2432.
Fragmentation Threshold	This is the maximum data fragment size that can be sent. Enter a value between 256 and 2432.
Output Power	Set the output power of the ZyXEL Device in this field. This control changes the strength of the ZyXEL Device's antenna gain or transmission power. Antenna gain is the increase in coverage. Higher antenna gain improves the range of the signal for better communications. If there is a high density of APs within an area, decrease the output power of the ZyXEL Device to reduce interference with other APs. The options are **Maximum**, **Middle** and **Minimum**.
Preamble	Select **Long** preamble if you are unsure what preamble mode the wireless adapters support, and to provide more reliable communications in busy wireless networks. Select **Short** preamble if you are sure the wireless adapters support it, and to provide more efficient communications. Select **Dynamic** to have the ZyXEL Device automatically use short preamble when wireless adapters support it, otherwise the ZyXEL Device uses long preamble.
802.11 Mode	Select **802.11b Only** to allow only IEEE 802.11b compliant WLAN devices to associate with the ZyXEL Device. Select **802.11g Only** to allow only IEEE 802.11g compliant WLAN devices to associate with the ZyXEL Device. Select **Mixed** to allow either IEEE802.11b or IEEE802.11g compliant WLAN devices to associate with the ZyXEL Device. The transmission rate of your ZyXEL Device might be reduced.
Back	Click **Back** to return to the previous screen.

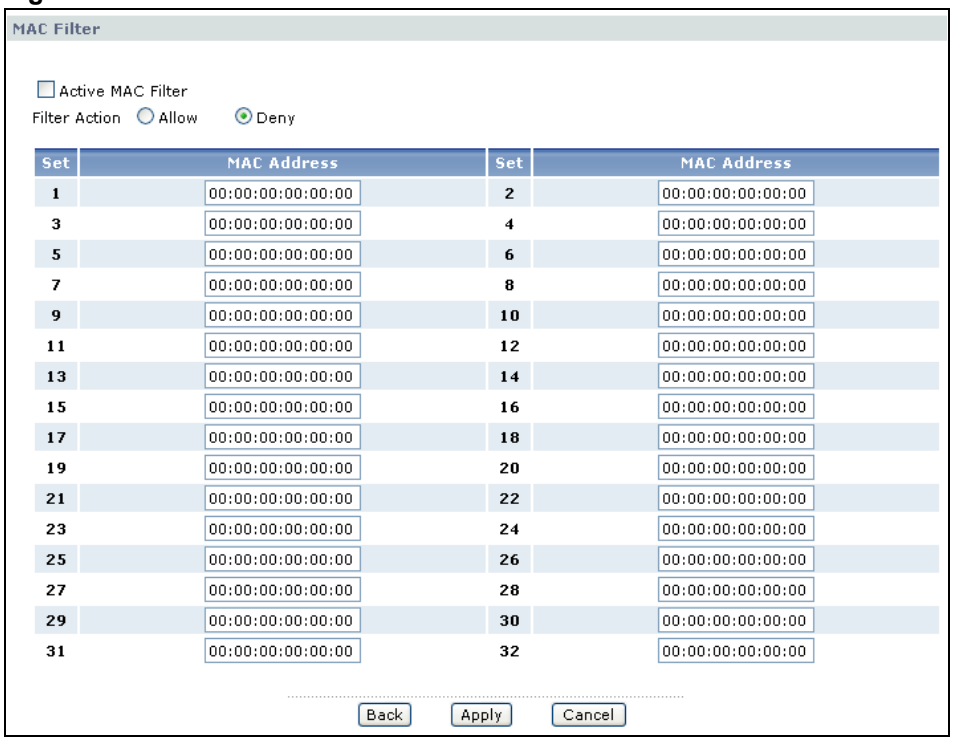
Table 50 Wireless LAN: Advanced

LABEL	DESCRIPTION
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Cancel	Click **Cancel** to reload the previous configuration for this screen.

9.3.6 MAC Filter

To change your ZyXEL Device's MAC filter settings, click the **Edit** icon in the **Network > Wireless LAN** screen. The screen appears as shown.

Figure 90 MAC Address Filter



The following table describes the labels in this menu.

Table 51 MAC Address Filter

LABEL	DESCRIPTION
Active MAC Filter	Select the check box to enable MAC address filtering.
Filter Action	Define the filter action for the list of MAC addresses in the **MAC Address** table. Select **Deny** to block access to the ZyXEL Device, MAC addresses not listed will be allowed to access the ZyXEL Device Select **Allow** to permit access to the ZyXEL Device, MAC addresses not listed will be denied access to the ZyXEL Device.
Set	This is the index number of the MAC address.
MAC Address	Enter the MAC addresses of the wireless client that are allowed or denied access to the ZyXEL Device in these address fields. Enter the MAC addresses in a valid MAC address format, that is, six hexadecimal character pairs, for example, 12:34:56:78:9a:bc.
Back	Click **Back** to return to the previous screen.

Table 51 MAC Address Filter

LABEL	DESCRIPTION
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Cancel	Click **Cancel** to reload the previous configuration for this screen.

9.4 WiFi Protected Setup

Your ZyXEL Device supports WiFi Protected Setup (WPS), which is an easy way to set up a secure wireless network. WPS is an industry standard specification, defined by the WiFi Alliance.

WPS allows you to quickly set up a wireless network with strong security, without having to configure security settings manually. Each WPS connection works between two devices. Both devices must support WPS (check each device's documentation to make sure).

Depending on the devices you have, you can either press a button (on the device itself, or in its configuration utility) or enter a PIN (a unique Personal Identification Number that allows one device to authenticate the other) in each of the two devices. When WPS is activated on a device, it has two minutes to find another device that also has WPS activated. Then, the two devices connect and set up a secure network by themselves.

9.4.1 Push Button Configuration

WPS Push Button Configuration (PBC) is initiated by pressing a button on each WPS-enabled device, and allowing them to connect automatically. You do not need to enter any information.

Not every WPS-enabled device has a physical WPS button. Some may have a WPS PBC button in their configuration utilities instead of or in addition to the physical button.

Take the following steps to set up WPS using the button.

1. Ensure that the two devices you want to set up are within wireless range of one another.
2. Look for a WPS button on each device. If the device does not have one, log into its configuration utility and locate the button (see the device's User's Guide for how to do this - for the ZyXEL Device, see Section 9.6 on page 146).
3. Press the button on one of the devices (it doesn't matter which). For the ZyXEL Device you must press the WPS button for more than three seconds.
4. Within two minutes, press the button on the other device. The registrar sends the network name (SSID) and security key through an secure connection to the enrollee.

If you need to make sure that WPS worked, check the list of associated wireless clients in the AP's configuration utility. If you see the wireless client in the list, WPS was successful.

9.4.2 PIN Configuration

Each WPS-enabled device has its own PIN (Personal Identification Number). This may either be static (it cannot be changed) or dynamic (in some devices you can generate a new PIN by clicking on a button in the configuration interface).

Use the PIN method instead of the push-button configuration (PBC) method if you want to ensure that the connection is established between the devices you specify, not just the first two devices to activate WPS in range of each other. However, you need to log into the configuration interfaces of both devices to use the PIN method.

When you use the PIN method, you must enter the PIN from one device (usually the wireless client) into the second device (usually the Access Point or wireless router). Then, when WPS is activated on the first device, it presents its PIN to the second device. If the PIN matches, one device sends the network and security information to the other, allowing it to join the network.

Take the following steps to set up a WPS connection between an access point or wireless router (referred to here as the AP) and a client device using the PIN method.

1. Ensure WPS is enabled on both devices.
2. Access the WPS section of the AP's configuration interface. See the device's User's Guide for how to do this.
3. Look for the client's WPS PIN; it will be displayed either on the device, or in the WPS section of the client's configuration interface (see the device's User's Guide for how to find the WPS PIN - for the ZyXEL Device, see Section 9.5 on page 145).
4. Enter the client's PIN in the AP's configuration interface.

If the client device's configuration interface has an area for entering another device's PIN, you can either enter the client's PIN in the AP, or enter the AP's PIN in the client - it does not matter which.

5. Start WPS on both devices within two minutes.

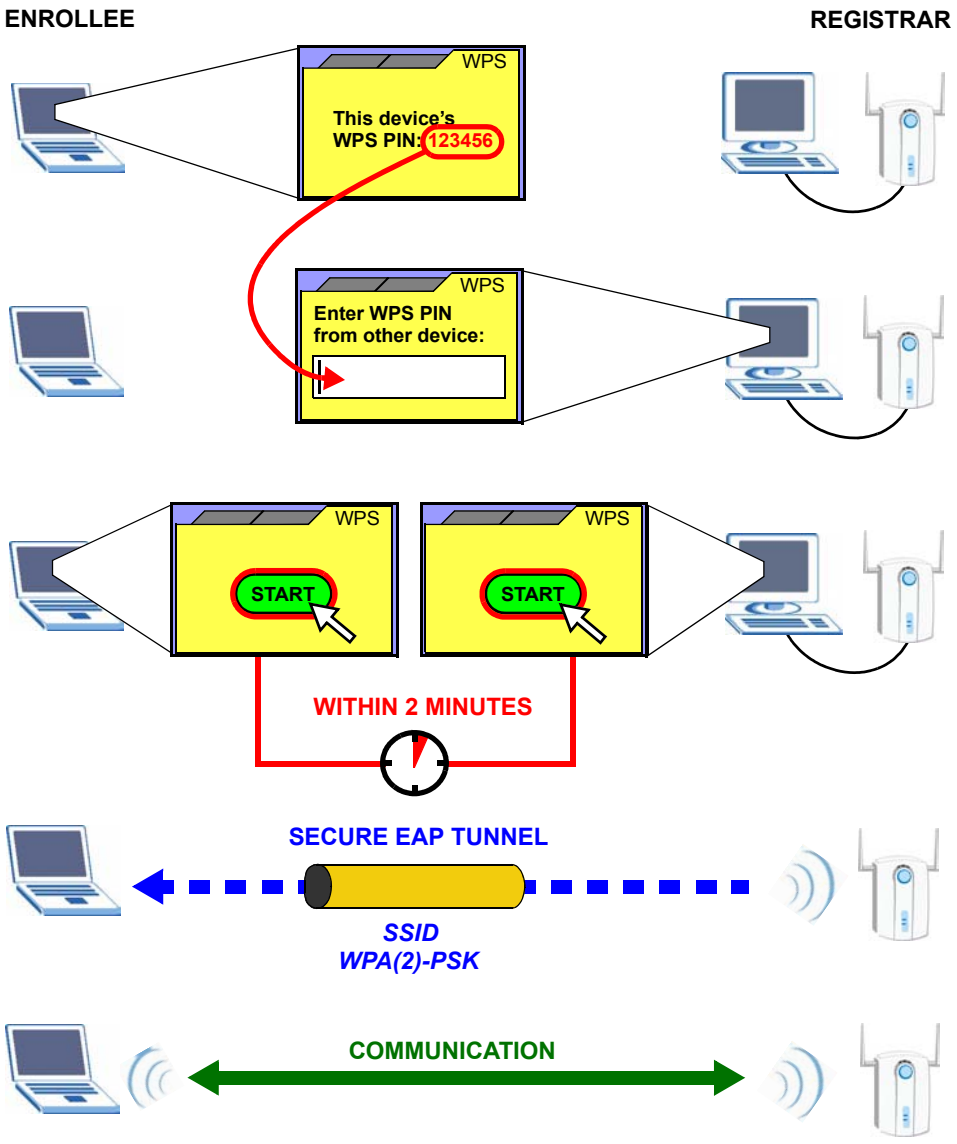
Use the configuration utility to activate WPS, not the push-button on the device itself.

6. On a computer connected to the wireless client, try to connect to the Internet. If you can connect, WPS was successful.

   If you cannot connect, check the list of associated wireless clients in the AP's configuration utility. If you see the wireless client in the list, WPS was successful.

The following figure shows a WPS-enabled wireless client (installed in a notebook computer) connecting to the WPS-enabled AP via the PIN method.

Figure 91 Example WPS Process: PIN Method

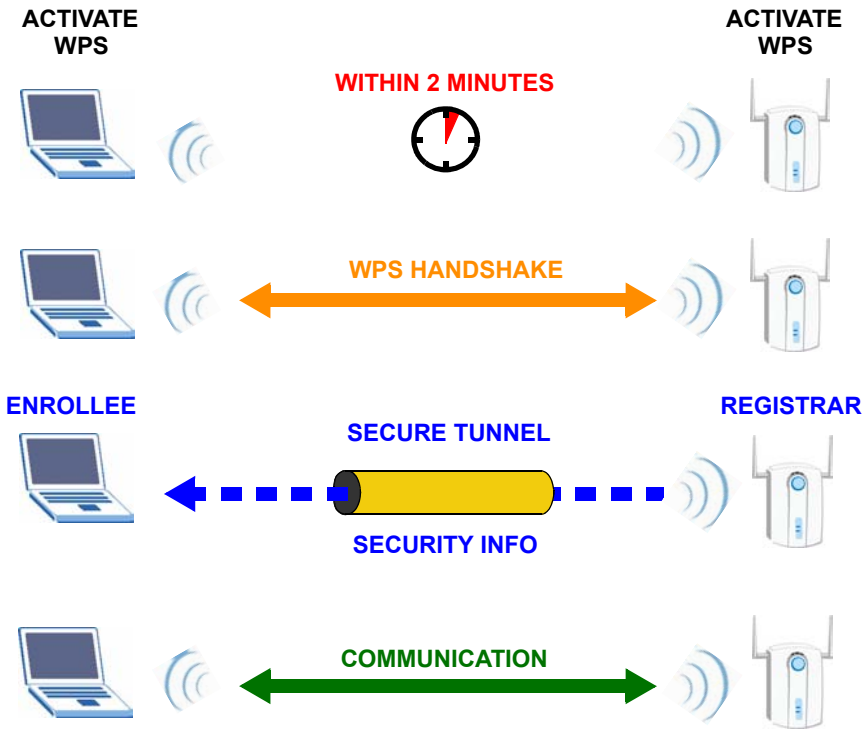


9.4.3 How WPS Works

When two WPS-enabled devices connect, each device must assume a specific role. One device acts as the registrar (the device that supplies network and security settings) and the other device acts as the enrollee (the device that receives network and security settings. The registrar creates a secure EAP (Extensible Authentication Protocol) tunnel and sends the network name (SSID) and the WPA-PSK or WPA2-PSK pre-shared key to the enrollee. Whether WPA-PSK or WPA2-PSK is used depends on the standards supported by the devices. If the registrar is already part of a network, it sends the existing information. If not, it generates the SSID and WPA(2)-PSK randomly.

The following figure shows a WPS-enabled client (installed in a notebook computer) connecting to a WPS-enabled access point.

Figure 92 How WPS works



The roles of registrar and enrollee last only as long as the WPS setup process is active (two minutes). The next time you use WPS, a different device can be the registrar if necessary.

The WPS connection process is like a handshake; only two devices participate in each WPS transaction. If you want to add more devices you should repeat the process with one of the existing networked devices and the new device.

Note that the access point (AP) is not always the registrar, and the wireless client is not always the enrollee. All WPS-certified APs can be a registrar, and so can some WPS-enabled wireless clients.

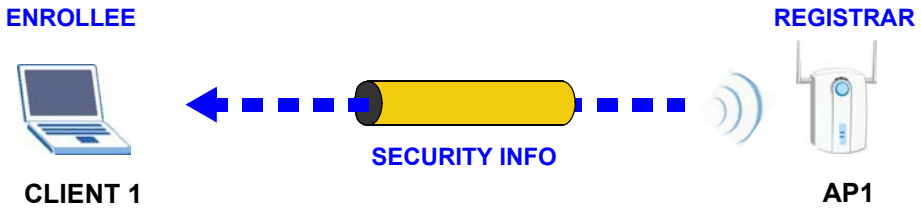
By default, a WPS devices is “unconfigured”. This means that it is not part of an existing network and can act as either enrollee or registrar (if it supports both functions). If the registrar is unconfigured, the security settings it transmits to the enrollee are randomly-generated. Once a WPS-enabled device has connected to another device using WPS, it becomes “configured”. A configured wireless client can still act as enrollee or registrar in subsequent WPS connections, but a configured access point can no longer act as enrollee. It will be the registrar in all subsequent WPS connections in which it is involved. If you want a configured AP to act as an enrollee, you must reset it to its factory defaults.

9.4.4 Example WPS Network Setup

This section shows how security settings are distributed in an example WPS setup.

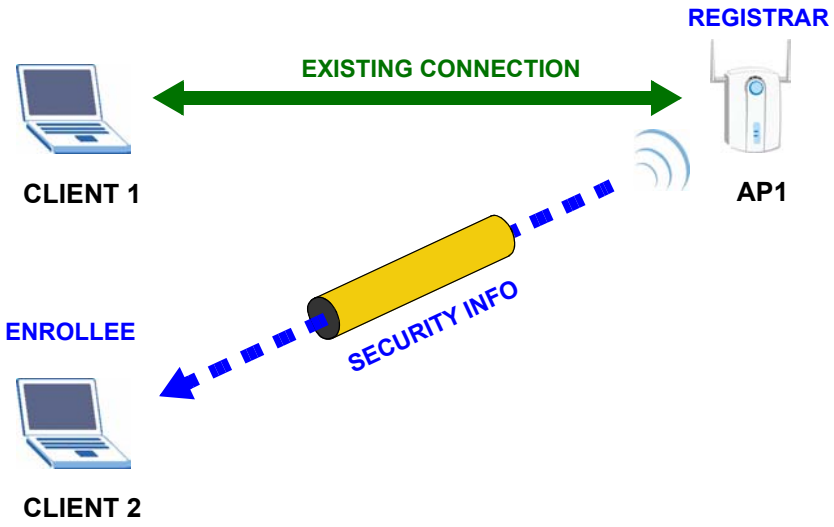
The following figure shows an example network. In step **1**, both **AP1** and **Client 1** are unconfigured. When WPS is activated on both, they perform the handshake. In this example, **AP1** is the registrar, and **Client 1** is the enrollee. The registrar randomly generates the security information to set up the network, since it is unconfigured and has no existing information.

Figure 93 WPS: Example Network Step 1



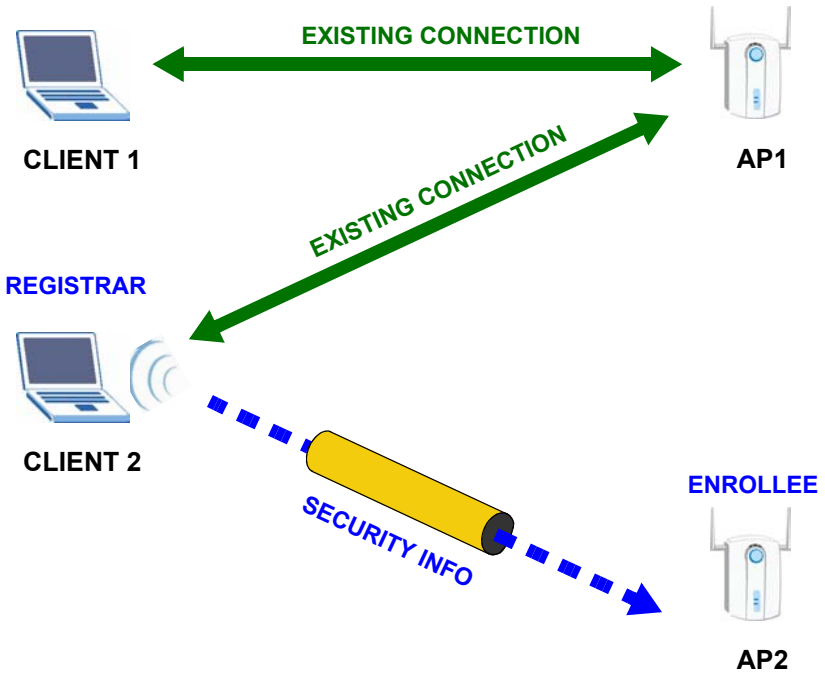
In step **2**, you add another wireless client to the network. You know that **Client 1** supports registrar mode, but it is better to use **AP1** for the WPS handshake with the new client since you must connect to the access point anyway in order to use the network. In this case, **AP1** must be the registrar, since it is configured (it already has security information for the network). **AP1** supplies the existing security information to **Client 2**.

Figure 94 WPS: Example Network Step 2



In step 3, you add another access point (**AP2**) to your network. **AP2** is out of range of **AP1**, so you cannot use **AP1** for the WPS handshake with the new access point. However, you know that **Client 2** supports the registrar function, so you use it to perform the WPS handshake instead.

Figure 95 WPS: Example Network Step 3



9.4.5 Limitations of WPS

WPS has some limitations of which you should be aware.

- WPS works in Infrastructure networks only (where an AP and a wireless client communicate). It does not work in Ad-Hoc networks (where there is no AP).
- When you use WPS, it works between two devices only. You cannot enroll multiple devices simultaneously, you must enroll one after the other.

  For instance, if you have two enrollees and one registrar you must set up the first enrollee (by pressing the WPS button on the registrar and the first enrollee, for example), then check that it successfully enrolled, then set up the second device in the same way.
- WPS works only with other WPS-enabled devices. However, you can still add non-WPS devices to a network you already set up using WPS.

  WPS works by automatically issuing a randomly-generated WPA-PSK or WPA2-PSK pre-shared key from the registrar device to the enrollee devices. Whether the network uses WPA-PSK or WPA2-PSK depends on the device. You can check the configuration interface of the registrar device to discover the key the network is using (if the device supports this feature). Then, you can enter the key into the non-WPS device and join the network as normal (the non-WPS device must also support WPA-PSK or WPA2-PSK).
- When you use the PBC method, there is a short period (from the moment you press the button on one device to the moment you press the button on the other device) when any WPS-enabled device could join the network. This is because the registrar has no way of identifying the “correct” enrollee, and cannot differentiate between your enrollee and a rogue device. This is a possible way for a hacker to gain access to a network.

You can easily check to see if this has happened. WPS works between only two devices simultaneously, so if another device has enrolled your device will be unable to enroll, and will not have access to the network. If this happens, open the access point's configuration interface and look at the list of associated clients (usually displayed by MAC address). It does not matter if the access point is the WPS registrar, the enrollee, or was not involved in the WPS handshake; a rogue device must still associate with the access point to gain access to the network. Check the MAC addresses of your wireless clients (usually printed on a label on the bottom of the device). If there is an unknown MAC address you can remove it or reset the AP.

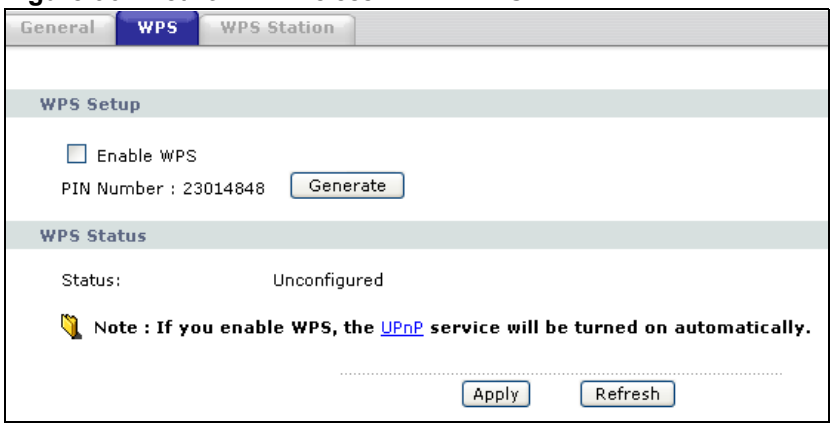
9.5 The WPS Screen

Use this screen to configure WiFi Protected Setup (WPS) on your ZyXEL Device.

WPS allows you to quickly set up a wireless network with strong security, without having to configure security settings manually. Set up each WPS connection between two devices. Both devices must support WPS.

Click **Network > Wireless LAN > WPS**. The following screen displays.

Figure 96 Network > Wireless LAN > WPS



The following table describes the labels in this screen.

Table 52 Network > Wireless LAN > WPS

LABEL	DESCRIPTION
WPS Setup	
Enable WPS	Select the check box to activate WPS on the ZyXEL Device.
PIN Number	This shows the PIN (Personal Identification Number) of the ZyXEL Device. Enter this PIN in the configuration utility of the device you want to connect to using WPS. The PIN is not necessary when you use WPS push-button method.
Generate	Click this button to have the ZyXEL Device create a new PIN.
WPS Status	This displays **Configured** when the ZyXEL Device has connected to a wireless network using WPS or **Enable WPS** is selected and wireless or wireless security settings have been changed. The current wireless and wireless security settings also appear in the screen. This displays **Unconfigured** if WPS is disabled and there is no wireless or wireless security changes on the ZyXEL Device or you click **Release_Configuration** to remove the configured wireless and wireless security settings.

Table 52 Network > Wireless LAN > WPS

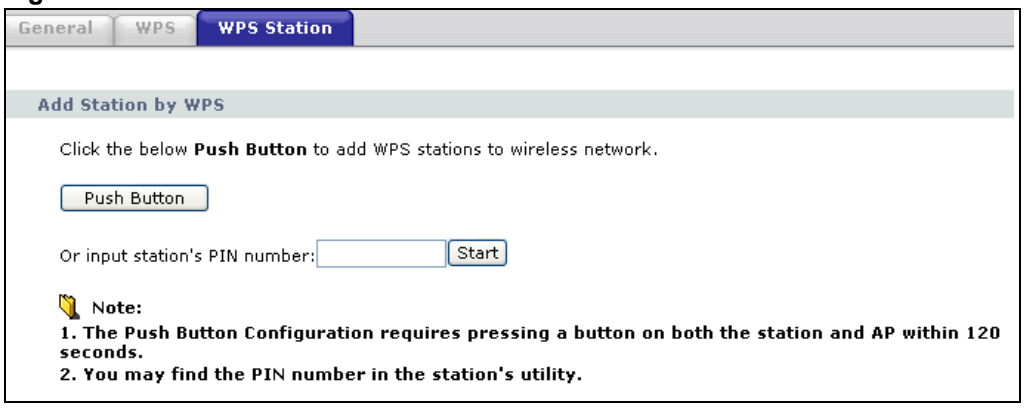
LABEL	DESCRIPTION
Release_Configuration	This button is available when the WPS status is **Configured.** Click this button to remove all configured wireless and wireless security settings for WPS connections on the ZyXEL Device.
Apply	Click this to save your changes.
Refresh	Click this to update the screen.

9.6 The WPS Station Screen

Use this screen to set up a WPS wireless network using either Push Button Configuration (PBC) or PIN Configuration.

Click **Network > Wireless LAN > WPS Station**. The following screen displays.

Figure 97 Network > Wireless LAN > WPS Station


General
WPS
WPS Station
Add Station by WPS
Click the below Push Button to add WPS stations to wireless network.
Push Button
Or input station's PIN number:
Start
Note:
1. The Push Button Configuration requires pressing a button on both the station and AP within 120 seconds.
2. You may find the PIN number in the station's utility.

The following table describes the labels in this screen.

Table 53 Network > Wireless LAN > WPS Station

LABEL	DESCRIPTION
Push Button	Click this to add another WPS-enabled wireless device (within wireless range of the ZyXEL Device) to your wireless network. This button may either be a physical button on the outside of device, or a menu button similar to the **Push Button** on this screen. Note: You must press the other wireless device's WPS button within two minutes of pressing this button.
Or input station's PIN number	Enter the PIN of the device that you are setting up a WPS connection with and click **Start** to authenticate and add the wireless device to your wireless network. You can find the PIN either on the outside of the device, or by checking the device's settings. Note: You must also activate WPS on that device within two minutes to have it present its PIN to the ZyXEL Device.

10

Network Address Translation (NAT)

This chapter discusses how to configure NAT on the ZyXEL Device.

10.1 NAT Overview

NAT (Network Address Translation - NAT, RFC 1631) is the translation of the IP address of a host in a packet, for example, the source address of an outgoing packet, used within one network to a different IP address known within another network.

10.1.1 NAT Definitions

Inside/outside denotes where a host is located relative to the ZyXEL Device, for example, the computers of your subscribers are the inside hosts, while the web servers on the Internet are the outside hosts.

Global/local denotes the IP address of a host in a packet as the packet traverses a router, for example, the local address refers to the IP address of a host when the packet is in the local network, while the global address refers to the IP address of the host when the same packet is traveling in the WAN side.

Note that inside/outside refers to the location of a host, while global/local refers to the IP address of a host used in a packet. Thus, an inside local address (ILA) is the IP address of an inside host in a packet when the packet is still in the local network, while an inside global address (IGA) is the IP address of the same inside host when the packet is on the WAN side. The following table summarizes this information.

Table 54 NAT Definitions

ITEM	DESCRIPTION
Inside	This refers to the host on the LAN.
Outside	This refers to the host on the WAN.
Local	This refers to the packet address (source or destination) as the packet travels on the LAN.
Global	This refers to the packet address (source or destination) as the packet travels on the WAN.

NAT never changes the IP address (either local or global) of an outside host.

10.1.2 What NAT Does

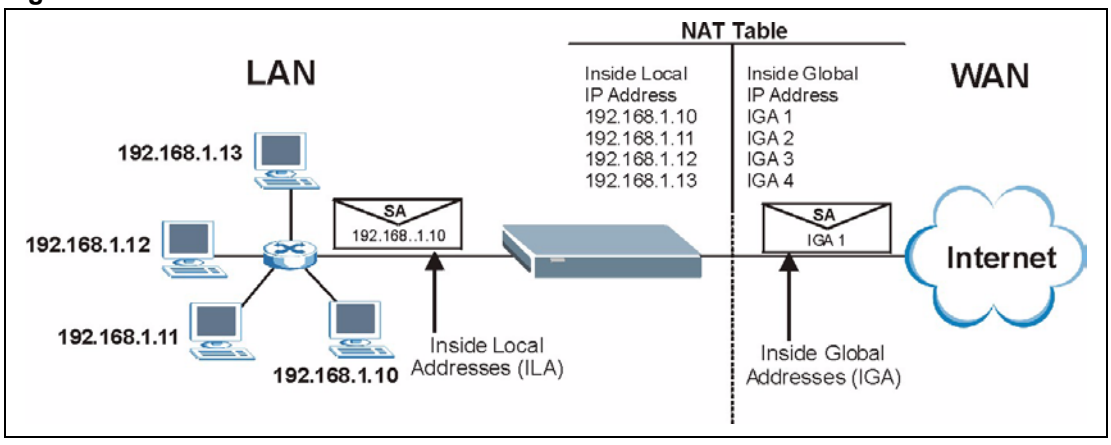
In the simplest form, NAT changes the source IP address in a packet received from a subscriber (the inside local address) to another (the inside global address) before forwarding the packet to the WAN side. When the response comes back, NAT translates the destination address (the inside global address) back to the inside local address before forwarding it to the original inside host. Note that the IP address (either local or global) of an outside host is never changed.

The global IP addresses for the inside hosts can be either static or dynamically assigned by the ISP. In addition, you can designate servers, for example, a web server and a telnet server, on your local network and make them accessible to the outside world. If you do not define any servers (for Many-to-One and Many-to-Many Overload mapping – see Table 55 on page 149), NAT offers the additional benefit of firewall protection. With no servers defined, your ZyXEL Device filters out all incoming inquiries, thus preventing intruders from probing your network. For more information on IP address translation, refer to *RFC 1631*, *The IP Network Address Translator (NAT)*.

10.1.3 How NAT Works

Each packet has two addresses – a source address and a destination address. For outgoing packets, the ILA (Inside Local Address) is the source address on the LAN, and the IGA (Inside Global Address) is the source address on the WAN. For incoming packets, the ILA is the destination address on the LAN, and the IGA is the destination address on the WAN. NAT maps private (local) IP addresses to globally unique ones required for communication with hosts on other networks. It replaces the original IP source address (and TCP or UDP source port numbers for Many-to-One and Many-to-Many Overload NAT mapping) in each packet and then forwards it to the Internet. The ZyXEL Device keeps track of the original addresses and port numbers so incoming reply packets can have their original values restored. The following figure illustrates this.

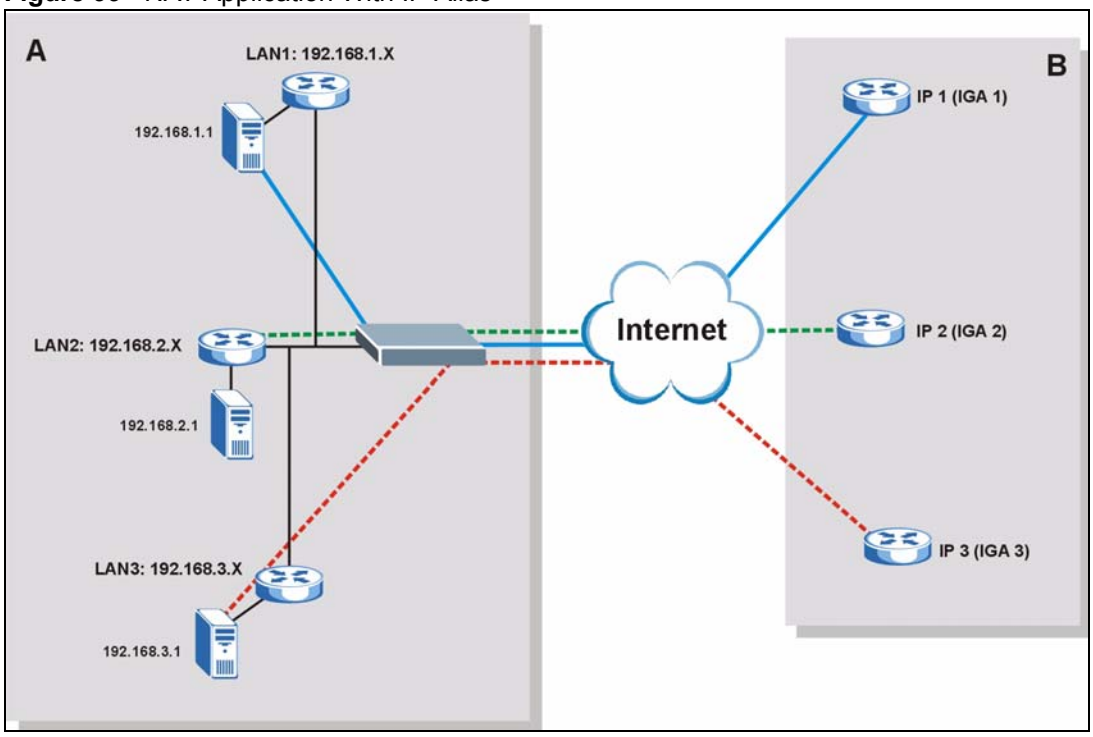
Figure 98 How NAT Works



10.1.4 NAT Application

The following figure illustrates a possible NAT application, where three inside LANs (logical LANs using IP Alias) behind the ZyXEL Device can communicate with three distinct WAN networks. More examples follow at the end of this chapter.

Figure 99 NAT Application With IP Alias



10.1.5 NAT Mapping Types

NAT supports five types of IP/port mapping. They are:

- **One to One**: In One-to-One mode, the ZyXEL Device maps one local IP address to one global IP address.
- **Many to One**: In Many-to-One mode, the ZyXEL Device maps multiple local IP addresses to one global IP address. This is equivalent to SUA (for instance, PAT, port address translation), ZyXEL's Single User Account feature that previous ZyXEL routers supported (the **SUA Only** option in today's routers).
- **Many to Many Overload**: In Many-to-Many Overload mode, the ZyXEL Device maps the multiple local IP addresses to shared global IP addresses.
- **Many-to-Many No Overload**: In Many-to-Many No Overload mode, the ZyXEL Device maps each local IP address to a unique global IP address.
- **Server**: This type allows you to specify inside servers of different services behind the NAT to be accessible to the outside world.

Port numbers do NOT change for **One-to-One** and **Many-to-Many No Overload** NAT mapping types.

The following table summarizes these types.

Table 55 NAT Mapping Types

TYPE	IP MAPPING
One-to-One	ILA1←→ IGA1
Many-to-One (SUA/PAT)	ILA1←→ IGA1 ILA2←→ IGA1 …

Table 55 NAT Mapping Types (continued)

TYPE	IP MAPPING
Many-to-Many Overload	ILA1←→ IGA1 ILA2←→ IGA2 ILA3←→ IGA1 ILA4←→ IGA2 …
Many-to-Many No Overload	ILA1←→ IGA1 ILA2←→ IGA2 ILA3←→ IGA3 …
Server	Server 1 IP←→ IGA1 Server 2 IP←→ IGA1 Server 3 IP←→ IGA1

10.2 SUA (Single User Account) Versus NAT

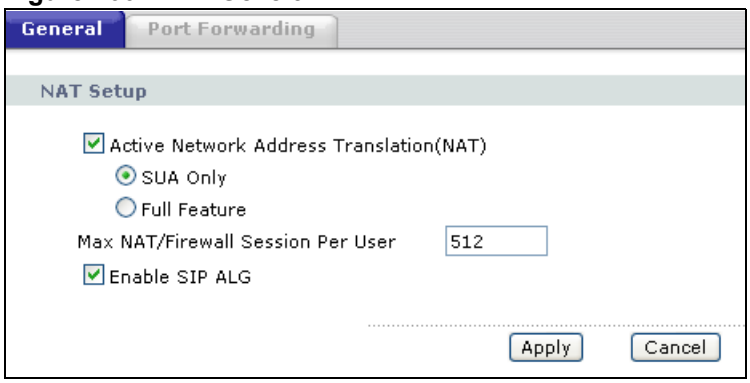
SUA (Single User Account) is a ZyNOS implementation of a subset of NAT that supports two types of mapping, **Many-to-One** and **Server**. The ZyXEL Device also supports **Full Feature** NAT to map multiple global IP addresses to multiple private LAN IP addresses of clients or servers using mapping types as outlined in Table 55 on page 149.

- Choose **SUA Only** if you have just one public WAN IP address for your ZyXEL Device.
- Choose **Full Feature** if you have multiple public WAN IP addresses for your ZyXEL Device.

10.3 NAT General Setup

You must create a firewall rule in addition to setting up SUA/NAT, to allow traffic from the WAN to be forwarded through the ZyXEL Device. Click **Network > NAT** to open the following screen. Not all fields are available on all models.

Figure 100 NAT General



The following table describes the labels in this screen.

Table 56 NAT General

LABEL	DESCRIPTION
Active Network Address Translation (NAT)	Select this check box to enable NAT.
SUA Only	Select this radio button if you have just one public WAN IP address for your ZyXEL Device.
Full Feature	Select this radio button if you have multiple public WAN IP addresses for your ZyXEL Device.
Max NAT/Firewall Session Per User	When computers use peer to peer applications, such as file sharing applications, they need to establish NAT sessions. If you do not limit the number of NAT sessions a single client can establish, this can result in all of the available NAT sessions being used. In this case, no additional NAT sessions can be established, and users may not be able to access the Internet. Each NAT session establishes a corresponding firewall session. Use this field to limit the number of NAT/firewall sessions each client computer can establish through the ZyXEL Device. If your network has a small number of clients using peer to peer applications, you can raise this number to ensure that their performance is not degraded by the number of NAT sessions they can establish. If your network has a large number of users using peer to peer applications, you can lower this number to ensure no single client is using all of the available NAT sessions.
Enable SIP ALG	Select this to make sure SIP (VoIP) works correctly with port-forwarding and address-mapping rules. Some NAT routers may include a SIP Application Layer Gateway (ALG). A SIP ALG allows SIP calls to pass through NAT by examining and translating IP addresses embedded in the data stream. When the ZyXEL Device registers with the SIP register server, the SIP ALG translates the ZyXEL Device's private IP address inside the SIP data stream to a public IP address. You do not need to use STUN or an outbound proxy if your ZyXEL Device is behind a SIP ALG.
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Cancel	Click **Cancel** to reload the previous configuration for this screen.

10.4 Port Forwarding

A port forwarding set is a list of inside (behind NAT on the LAN) servers, for example, web or FTP, that you can make visible to the outside world even though NAT makes your whole inside network appear as a single computer to the outside world.

You may enter a single port number or a range of port numbers to be forwarded, and the local IP address of the desired server. The port number identifies a service; for example, web service is on port 80 and FTP on port 21. In some cases, such as for unknown services or where one server can support more than one service (for example both FTP and web service), it might be better to specify a range of port numbers. You can allocate a server IP address that corresponds to a port or a range of ports.

Many residential broadband ISP accounts do not allow you to run any server processes (such as a Web or FTP server) from your location. Your ISP may periodically check for servers and may suspend your account if it discovers any active services at your location. If you are unsure, refer to your ISP.

10.4.1 Default Server IP Address

In addition to the servers for specified services, NAT supports a default server IP address. A default server receives packets from ports that are not specified in this screen.

If you do not assign a **Default Server** IP address, the ZyXEL Device discards all packets received for ports that are not specified here or in the remote management setup.

10.4.2 Port Forwarding: Services and Port Numbers

Use the **Port Forwarding** screen to forward incoming service requests to the server(s) on your local network.

The most often used port numbers are shown in the following table. Please refer to RFC 1700 for further information about port numbers.

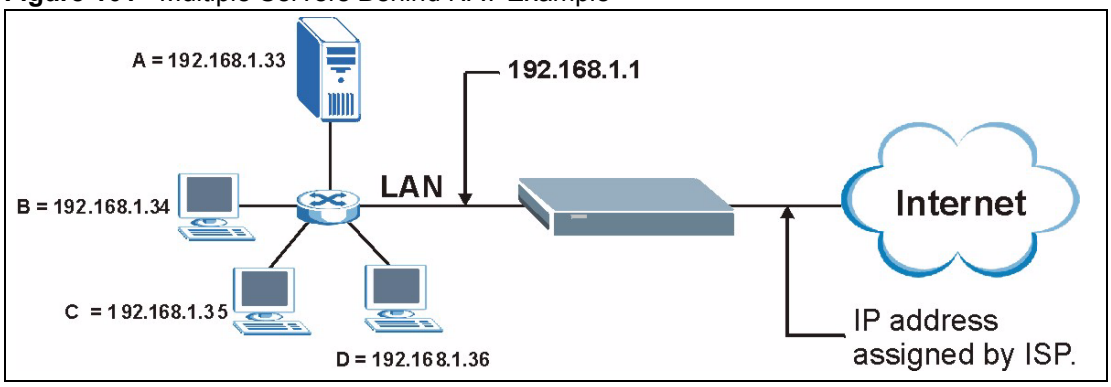
Table 57 Services and Port Numbers

SERVICES	PORT NUMBER
ECHO	7
FTP (File Transfer Protocol)	21
SMTP (Simple Mail Transfer Protocol)	25
DNS (Domain Name System)	53
Finger	79
HTTP (Hyper Text Transfer protocol or WWW, Web)	80
POP3 (Post Office Protocol)	110
NNTP (Network News Transport Protocol)	119
SNMP (Simple Network Management Protocol)	161
SNMP trap	162
PPTP (Point-to-Point Tunneling Protocol)	1723

10.4.3 Configuring Servers Behind Port Forwarding (Example)

Let's say you want to assign ports 21-25 to one FTP, Telnet and SMTP server (**A** in the example), port 80 to another (**B** in the example) and assign a default server IP address of 192.168.1.35 to a third (**C** in the example). You assign the LAN IP addresses and the ISP assigns the WAN IP address. The NAT network appears as a single host on the Internet.

Figure 101 Multiple Servers Behind NAT Example



10.5 Configuring Port Forwarding

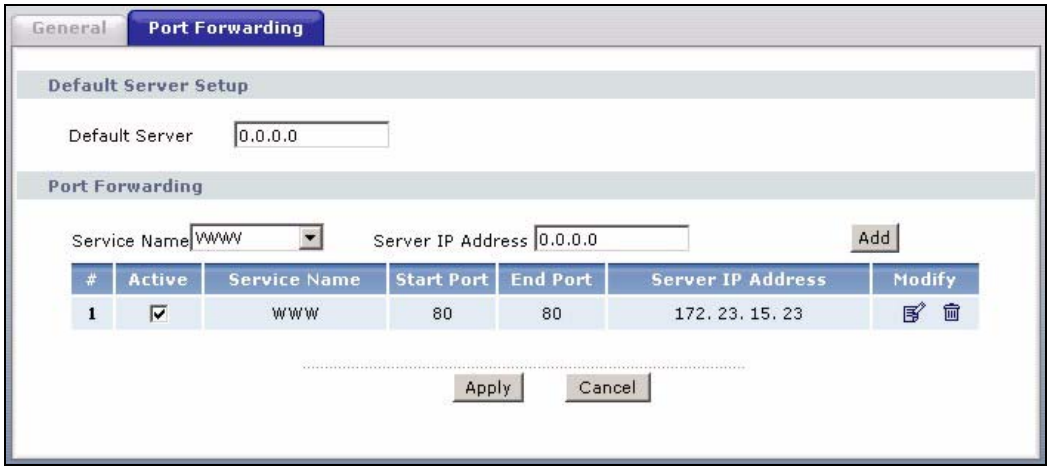
The **Port Forwarding** screen is available only when you select **SUA Only** in the **NAT > General** screen.

If you do not assign a **Default Server** IP address, the ZyXEL Device discards all packets received for ports that are not specified here or in the remote management setup.

Click **Network > NAT > Port Forwarding** to open the following screen.

See Table 57 on page 152 for port numbers commonly used for particular services.

Figure 102 NAT Port Forwarding



The following table describes the fields in this screen.

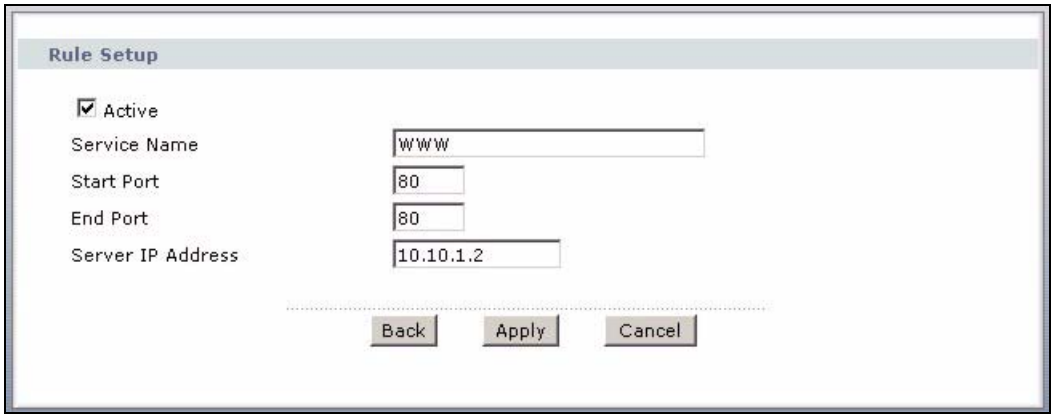
Table 58 NAT Port Forwarding

LABEL	DESCRIPTION
Default Server Setup	
Default Server	In addition to the servers for specified services, NAT supports a default server. A default server receives packets from ports that are not specified in this screen. If you do not assign a **Default Server** IP address, the ZyXEL Device discards all packets received for ports that are not specified here or in the remote management setup.
Port Forwarding	
Service Name	Select a service from the drop-down list box.
Server IP Address	Enter the IP address of the server for the specified service.
Add	Click this button to add a rule to the table below.
#	This is the rule index number (read-only).
Active	Click this check box to enable the rule.
Service Name	This is a service's name.
Start Port	This is the first port number that identifies a service.
End Port	This is the last port number that identifies a service.
Server IP Address	This is the server's IP address.
Modify	Click the edit icon to go to the screen where you can edit the port forwarding rule. Click the delete icon to delete an existing port forwarding rule. Note that subsequent rules move up by one when you take this action.
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Cancel	Click **Cancel** to return to the previous configuration.

10.5.1 Port Forwarding Rule Edit

To edit a port forwarding rule, click the rule's edit icon in the **Port Forwarding** screen to display the screen shown next.

Figure 103 Port Forwarding Rule Setup



The following table describes the fields in this screen.

Table 59 Port Forwarding Rule Setup

LABEL	DESCRIPTION
Active	Click this check box to enable the rule.
Service Name	Enter a name to identify this port-forwarding rule.
Start Port	Enter a port number in this field. To forward only one port, enter the port number again in the **End Port** field. To forward a series of ports, enter the start port number here and the end port number in the **End Port** field.
End Port	Enter a port number in this field. To forward only one port, enter the port number again in the **Start Port** field above and then enter it again in this field. To forward a series of ports, enter the last port number in a series that begins with the port number in the **Start Port** field above.
Server IP Address	Enter the inside IP address of the server here.
Back	Click **Back** to return to the previous screen.
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.

PART IV
Security

Firewalls (159)
Firewall Configuration (173)
Content Filtering (195)

11

Firewalls

This chapter gives some background information on firewalls and introduces the ZyXEL Device firewall.

11.1 Firewall Overview

Originally, the term firewall referred to a construction technique designed to prevent the spread of fire from one room to another. The networking term “firewall” is a system or group of systems that enforces an access-control policy between two networks. It may also be defined as a mechanism used to protect a trusted network from an untrusted network. Of course, firewalls cannot solve every security problem. A firewall is one of the mechanisms used to establish a network security perimeter in support of a network security policy. It should never be the only mechanism or method employed. For a firewall to guard effectively, you must design and deploy it appropriately. This requires integrating the firewall into a broad information-security policy. In addition, specific policies must be implemented within the firewall itself.

Refer to Section 12.5 on page 176 to configure default firewall settings.

Refer to Section 12.6 on page 177 to view firewall rules.

Refer to Section 12.6.1 on page 179 to configure firewall rules.

Refer to Section 12.6.2 on page 182 to configure a custom service.

Refer to Section 12.10.3 on page 191 to configure firewall thresholds.

11.2 Types of Firewalls

There are three main types of firewalls:

- Packet Filtering Firewalls
- Application-level Firewalls
- Stateful Inspection Firewalls

11.2.1 Packet Filtering Firewalls

Packet filtering firewalls restrict access based on the source/destination computer network address of a packet and the type of application.

11.2.2 Application-level Firewalls

Application-level firewalls restrict access by serving as proxies for external servers. Since they use programs written for specific Internet services, such as HTTP, FTP and telnet, they can evaluate network packets for valid application-specific data. Application-level gateways have a number of general advantages over the default mode of permitting application traffic directly to internal hosts:

Information hiding prevents the names of internal systems from being made known via DNS to outside systems, since the application gateway is the only host whose name must be made known to outside systems.

Robust authentication and logging pre-authenticates application traffic before it reaches internal hosts and causes it to be logged more effectively than if it were logged with standard host logging. Filtering rules at the packet filtering router can be less complex than they would be if the router needed to filter application traffic and direct it to a number of specific systems. The router need only allow application traffic destined for the application gateway and reject the rest.

11.2.3 Stateful Inspection Firewalls

Stateful inspection firewalls restrict access by screening data packets against defined access rules. They make access control decisions based on IP address and protocol. They also "inspect" the session data to assure the integrity of the connection and to adapt to dynamic protocols. These firewalls generally provide the best speed and transparency, however, they may lack the granular application level access control or caching that some proxies support. See Section 11.5 on page 164 for more information on stateful inspection.

Firewalls, of one type or another, have become an integral part of standard security solutions for enterprises.

11.3 Introduction to ZyXEL's Firewall

The ZyXEL Device firewall is a stateful inspection firewall and is designed to protect against Denial of Service attacks when activated. The ZyXEL Device's purpose is to allow a private Local Area Network (LAN) to be securely connected to the Internet. The ZyXEL Device can be used to prevent theft, destruction and modification of data, as well as log events, which may be important to the security of your network. The ZyXEL Device also has packet filtering capabilities.

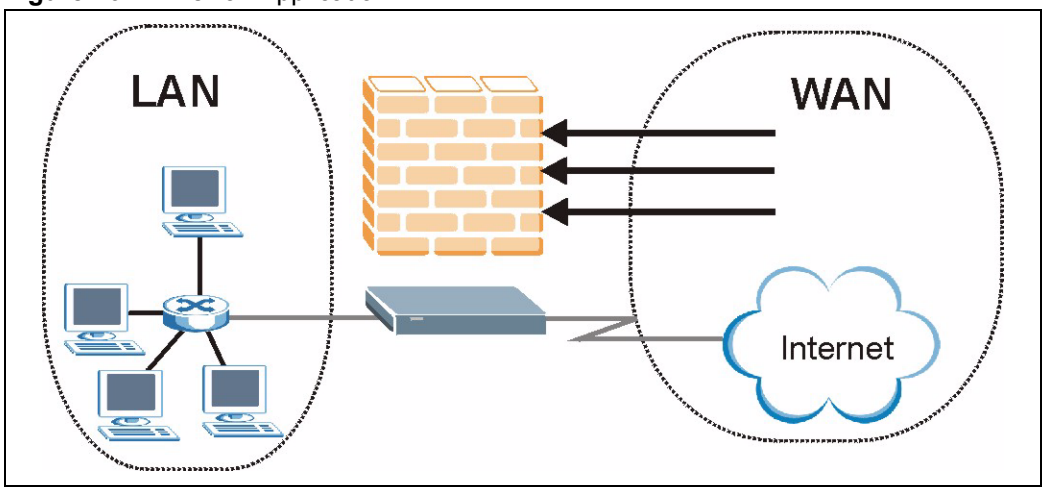
The ZyXEL Device is installed between the LAN and the Internet. This allows it to act as a secure gateway for all data passing between the Internet and the LAN.

The ZyXEL Device has one DSL/ISDN port and one Ethernet LAN port, which physically separate the network into two areas.

- The DSL/ISDN port connects to the Internet.
- The LAN (Local Area Network) port attaches to a network of computers, which needs security from the outside world. These computers will have access to Internet services such as e-mail, FTP, and the World Wide Web. However, "inbound access" will not be allowed unless you configure remote management or create a firewall rule to allow a remote host to use a specific service.

11.3.1 Denial of Service Attacks

Figure 104 Firewall Application



11.4 Denial of Service

Denials of Service (DoS) attacks are aimed at devices and networks with a connection to the Internet. Their goal is not to steal information, but to disable a device or network so users no longer have access to network resources. The ZyXEL Device is pre-configured to automatically detect and thwart all known DoS attacks.

11.4.1 Basics

Computers share information over the Internet using a common language called TCP/IP. TCP/IP, in turn, is a set of application protocols that perform specific functions. An “extension number”, called the "TCP port" or "UDP port" identifies these protocols, such as HTTP (Web), FTP (File Transfer Protocol), POP3 (E-mail), etc. For example, Web traffic by default uses TCP port 80.

When computers communicate on the Internet, they are using the client/server model, where the server "listens" on a specific TCP/UDP port for information requests from remote client computers on the network. For example, a Web server typically listens on port 80. Please note that while a computer may be intended for use over a single port, such as Web on port 80, other ports are also active. If the person configuring or managing the computer is not careful, a hacker could attack it over an unprotected port.

Some of the most common IP ports are:

Table 60 Common IP Ports

21	FTP	53	DNS
23	Telnet	80	HTTP
25	SMTP	110	POP3

11.4.2 Types of DoS Attacks

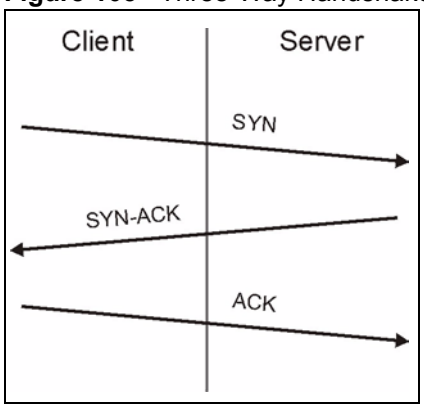
There are four types of DoS attacks:

1. Those that exploit bugs in a TCP/IP implementation.
2. Those that exploit weaknesses in the TCP/IP specification.
3. Brute-force attacks that flood a network with useless data.
4. IP Spoofing.
5. "**Ping of Death**" and "**Teardrop**" attacks exploit bugs in the TCP/IP implementations of various computer and host systems.

- Ping of Death uses a "ping" utility to create an IP packet that exceeds the maximum 65,536 bytes of data allowed by the IP specification. The oversize packet is then sent to an unsuspecting system. Systems may crash, hang or reboot.
- Teardrop attack exploits weaknesses in the re-assembly of IP packet fragments. As data is transmitted through a network, IP packets are often broken up into smaller chunks. Each fragment looks like the original IP packet except that it contains an offset field that says, for instance, "This fragment is carrying bytes 200 through 400 of the original (non fragmented) IP packet." The Teardrop program creates a series of IP fragments with overlapping offset fields. When these fragments are reassembled at the destination, some systems will crash, hang, or reboot.

6. Weaknesses in the TCP/IP specification leave it open to "**SYN Flood**" and "**LAND**" attacks. These attacks are executed during the handshake that initiates a communication session between two applications.

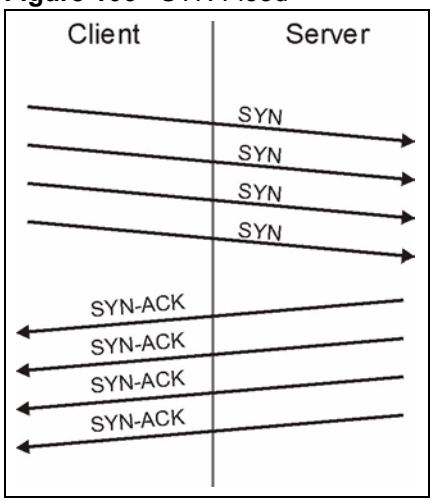
Figure 105 Three-Way Handshake



Under normal circumstances, the application that initiates a session sends a SYN (synchronize) packet to the receiving server. The receiver sends back an ACK (acknowledgment) packet and its own SYN, and then the initiator responds with an ACK (acknowledgment). After this handshake, a connection is established.

- **SYN Attack** floods a targeted system with a series of SYN packets. Each packet causes the targeted system to issue a SYN-ACK response. While the targeted system waits for the ACK that follows the SYN-ACK, it queues up all outstanding SYN-ACK responses on what is known as a backlog queue. SYN-ACKs are moved off the queue only when an ACK comes back or when an internal timer (which is set at relatively long intervals) terminates the three-way handshake. Once the queue is full, the system will ignore all incoming SYN requests, making the system unavailable for legitimate users.

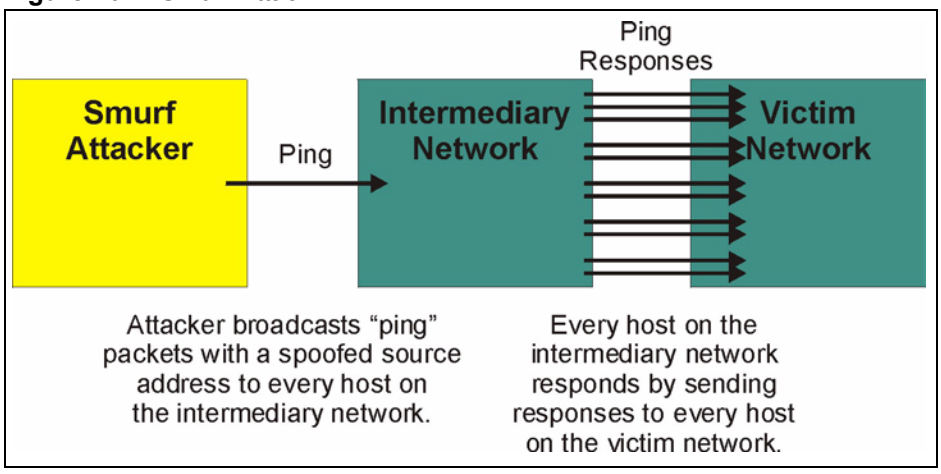
Figure 106 SYN Flood



- In a **LAND Attack**, hackers flood SYN packets into the network with a spoofed source IP address of the targeted system. This makes it appear as if the host computer sent the packets to itself, making the system unavailable while the target system tries to respond to itself.

7 A **brute-force** attack, such as a "Smurf" attack, targets a feature in the IP specification known as directed or subnet broadcasting, to quickly flood the target network with useless data. A Smurf hacker floods a router with Internet Control Message Protocol (ICMP) echo request packets (pings). Since the destination IP address of each packet is the broadcast address of the network, the router will broadcast the ICMP echo request packet to all hosts on the network. If there are numerous hosts, this will create a large amount of ICMP echo request and response traffic. If a hacker chooses to spoof the source IP address of the ICMP echo request packet, the resulting ICMP traffic will not only clog up the "intermediary" network, but will also congest the network of the spoofed source IP address, known as the "victim" network. This flood of broadcast traffic consumes all available bandwidth, making communications impossible.

Figure 107 Smurf Attack



11.4.2.1 ICMP Vulnerability

ICMP is an error-reporting protocol that works in concert with IP. The following ICMP types trigger an alert:

Table 61 ICMP Commands That Trigger Alerts

5	REDIRECT
13	TIMESTAMP_REQUEST
14	TIMESTAMP_REPLY
17	ADDRESS_MASK_REQUEST
18	ADDRESS_MASK_REPLY

11.4.2.2 Illegal Commands (NetBIOS and SMTP)

The only legal NetBIOS commands are the following - all others are illegal.

Table 62 Legal NetBIOS Commands

MESSAGE:
REQUEST:
POSITIVE:
VE:
RETARGET:
KEEPALIVE:

All SMTP commands are illegal except for those displayed in the following tables.

Table 63 Legal SMTP Commands

AUTH	DATA	EHLO	ETRN	EXPN	HELO	HELP	MAIL	NOOP
QUIT	RCPT	RSET	SAML	SEND	SOML	TURN	VRFY	

11.4.2.3 Traceroute

Traceroute is a utility used to determine the path a packet takes between two endpoints. Sometimes when a packet filter firewall is configured incorrectly an attacker can traceroute the firewall gaining knowledge of the network topology inside the firewall.

Often, many DoS attacks also employ a technique known as "**IP Spoofing**" as part of their attack. IP Spoofing may be used to break into systems, to hide the hacker's identity, or to magnify the effect of the DoS attack. IP Spoofing is a technique used to gain unauthorized access to computers by tricking a router or firewall into thinking that the communications are coming from within the trusted network. To engage in IP spoofing, a hacker must modify the packet headers so that it appears that the packets originate from a trusted host and should be allowed through the router or firewall. The ZyXEL Device blocks all IP Spoofing attempts.

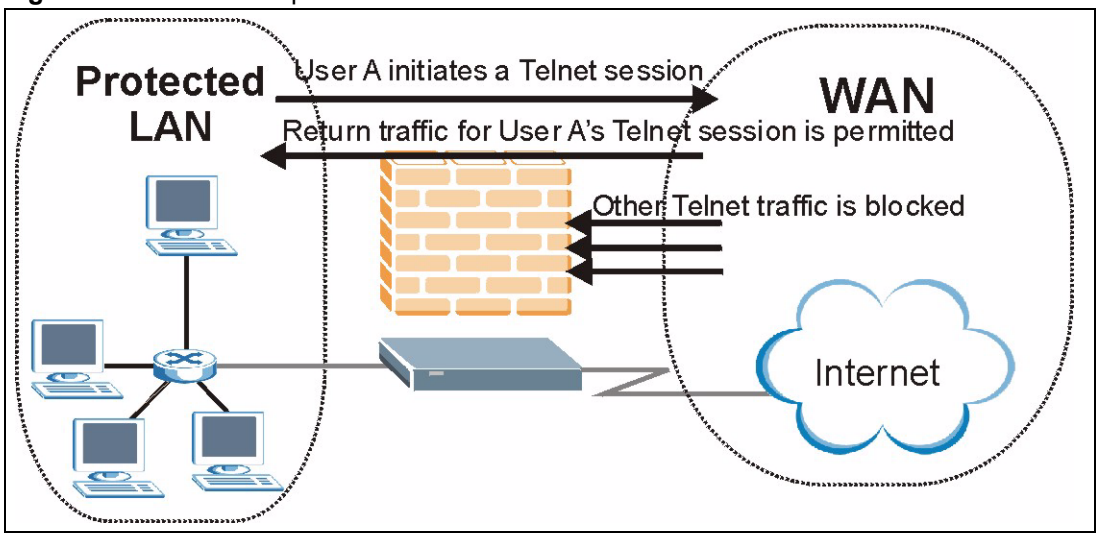
11.5 Stateful Inspection

With stateful inspection, fields of the packets are compared to packets that are already known to be trusted. For example, if you access some outside service, the proxy server remembers things about your original request, like the port number and source and destination addresses. This “remembering” is called *saving the state.* When the outside system responds to your request, the firewall compares the received packets with the saved state to determine if they

are allowed in. The ZyXEL Device uses stateful packet inspection to protect the private LAN from hackers and vandals on the Internet. By default, the ZyXEL Device's stateful inspection allows all communications to the Internet that originate from the LAN, and blocks all traffic to the LAN that originates from the Internet. In summary, stateful inspection:

- Allows all sessions originating from the LAN (local network) to the WAN (Internet).
- Denies all sessions originating from the WAN to the LAN.

Figure 108 Stateful Inspection


Protected LAN
User A initiates a Telnet session
WAN
Return traffic for User A's Telnet session is permitted
Other Telnet traffic is blocked
Internet

The previous figure shows the ZyXEL Device's default firewall rules in action as well as demonstrates how stateful inspection works. User A can initiate a Telnet session from within the LAN and responses to this request are allowed. However other Telnet traffic initiated from the WAN is blocked.

11.5.1 Stateful Inspection Process

In this example, the following sequence of events occurs when a TCP packet leaves the LAN network through the firewall's WAN interface. The TCP packet is the first in a session, and the packet's application layer protocol is configured for a firewall rule inspection:

1. The packet travels from the firewall's LAN to the WAN.
2. The packet is evaluated against the interface's existing outbound access list, and the packet is permitted (a denied packet would simply be dropped at this point).
3. The packet is inspected by a firewall rule to determine and record information about the state of the packet's connection. This information is recorded in a new state table entry created for the new connection. If there is not a firewall rule for this packet and it is not an attack, then the settings in the **Firewall General** screen determine the action for this packet.
4. Based on the obtained state information, a firewall rule creates a temporary access list entry that is inserted at the beginning of the WAN interface's inbound extended access list. This temporary access list entry is designed to permit inbound packets of the same connection as the outbound packet just inspected.
5. The outbound packet is forwarded out through the interface.

6 Later, an inbound packet reaches the interface. This packet is part of the connection previously established with the outbound packet. The inbound packet is evaluated against the inbound access list, and is permitted because of the temporary access list entry previously created.
7 The packet is inspected by a firewall rule, and the connection's state table entry is updated as necessary. Based on the updated state information, the inbound extended access list temporary entries might be modified, in order to permit only packets that are valid for the current state of the connection.
8 Any additional inbound or outbound packets that belong to the connection are inspected to update the state table entry and to modify the temporary inbound access list entries as required, and are forwarded through the interface.
9 When the connection terminates or times out, the connection's state table entry is deleted and the connection's temporary inbound access list entries are deleted.

11.5.2 Stateful Inspection and the ZyXEL Device

Additional rules may be defined to extend or override the default rules. For example, a rule may be created which will:

- Block all traffic of a certain type, such as IRC (Internet Relay Chat), from the LAN to the Internet.
- Allow certain types of traffic from the Internet to specific hosts on the LAN.
- Allow access to a Web server to everyone but competitors.
- Restrict use of certain protocols, such as Telnet, to authorized users on the LAN.

These custom rules work by evaluating the network traffic's Source IP address, Destination IP address, IP protocol type, and comparing these to rules set by the administrator.

The ability to define firewall rules is a very powerful tool. Using custom rules, it is possible to disable all firewall protection or block all access to the Internet. Use extreme caution when creating or deleting firewall rules. Test changes after creating them to make sure they work correctly.

Below is a brief technical description of how these connections are tracked. Connections may either be defined by the upper protocols (for instance, TCP), or by the ZyXEL Device itself (as with the "virtual connections" created for UDP and ICMP).

11.5.3 TCP Security

The ZyXEL Device uses state information embedded in TCP packets. The first packet of any new connection has its SYN flag set and its ACK flag cleared; these are "initiation" packets. All packets that do not have this flag structure are called "subsequent" packets, since they represent data that occurs later in the TCP stream.

If an initiation packet originates on the WAN, this means that someone is trying to make a connection from the Internet into the LAN. Except in a few special cases (see "Upper Layer Protocols" shown next), these packets are dropped and logged.

If an initiation packet originates on the LAN, this means that someone is trying to make a connection from the LAN to the Internet. Assuming that this is an acceptable part of the security policy (as is the case with the default policy), the connection will be allowed. A cache entry is added which includes connection information such as IP addresses, TCP ports, sequence numbers, etc.

When the ZyXEL Device receives any subsequent packet (from the Internet or from the LAN), its connection information is extracted and checked against the cache. A packet is only allowed to pass through if it corresponds to a valid connection (that is, if it is a response to a connection which originated on the LAN).

11.5.4 UDP/ICMP Security

UDP and ICMP do not themselves contain any connection information (such as sequence numbers). However, at the very minimum, they contain an IP address pair (source and destination). UDP also contains port pairs, and ICMP has type and code information. All of this data can be analyzed in order to build "virtual connections" in the cache.

For instance, any UDP packet that originates on the LAN will create a cache entry. Its IP address and port pairs will be stored. For a short period of time, UDP packets from the WAN that have matching IP and UDP information will be allowed back in through the firewall.

A similar situation exists for ICMP, except that the ZyXEL Device is even more restrictive. Specifically, only outgoing echoes will allow incoming echo replies, outgoing address mask requests will allow incoming address mask replies, and outgoing timestamp requests will allow incoming timestamp replies. No other ICMP packets are allowed in through the firewall, simply because they are too dangerous and contain too little tracking information. For instance, ICMP redirect packets are never allowed in, since they could be used to reroute traffic through attacking machines.

11.5.5 Upper Layer Protocols

Some higher layer protocols (such as FTP and RealAudio) utilize multiple network connections simultaneously. In general terms, they usually have a "control connection" which is used for sending commands between endpoints, and then "data connections" which are used for transmitting bulk information.

Consider the FTP protocol. A user on the LAN opens a control connection to a server on the Internet and requests a file. At this point, the remote server will open a data connection from the Internet. For FTP to work properly, this connection must be allowed to pass through even though a connection from the Internet would normally be rejected.

In order to achieve this, the ZyXEL Device inspects the application-level FTP data. Specifically, it searches for outgoing "PORT" commands, and when it sees these, it adds a cache entry for the anticipated data connection. This can be done safely, since the PORT command contains address and port information, which can be used to uniquely identify the connection.

Any protocol that operates in this way must be supported on a case-by-case basis. You can use the web configurator’s Custom Ports feature to do this.

11.6 Guidelines for Enhancing Security with Your Firewall

- Change the default password via CLI (Command Line Interpreter) or web configurator.
- Limit who can telnet into your router.
- Don't enable any local service (such as SNMP or NTP) that you don't use. Any enabled service could present a potential security risk. A determined hacker might be able to find creative ways to misuse the enabled services to access the firewall or the network.
- For local services that are enabled, protect against misuse. Protect by configuring the services to communicate only with specific peers, and protect by configuring rules to block packets for the services at specific interfaces.
- Protect against IP spoofing by making sure the firewall is active.
- Keep the firewall in a secured (locked) room.

11.6.1 Security In General

You can never be too careful! Factors outside your firewall, filtering or NAT can cause security breaches. Below are some generalizations about what you can do to minimize them.

- Encourage your company or organization to develop a comprehensive security plan. Good network administration takes into account what hackers can do and prepares against attacks. The best defense against hackers and crackers is information. Educate all employees about the importance of security and how to minimize risk. Produce lists like this one!
- DSL or cable modem connections are “always-on” connections and are particularly vulnerable because they provide more opportunities for hackers to crack your system. Turn your computer off when not in use.
- Never give out a password or any sensitive information to an unsolicited telephone call or e-mail.
- Never e-mail sensitive information such as passwords, credit card information, etc., without encrypting the information first.
- Never submit sensitive information via a web page unless the web site uses secure connections. You can identify a secure connection by looking for a small “key” icon on the bottom of your browser (Internet Explorer 3.02 or better or Netscape 3.0 or better). If a web site uses a secure connection, it is safe to submit information. Secure web transactions are quite difficult to crack.
- Never reveal your IP address or other system networking information to people outside your company. Be careful of files e-mailed to you from strangers. One common way of getting BackOrifice on a system is to include it as a Trojan horse with other files.
- Change your passwords regularly. Also, use passwords that are not easy to figure out. The most difficult passwords to crack are those with upper and lower case letters, numbers and a symbol such as % or #.
- Upgrade your software regularly. Many older versions of software, especially web browsers, have well known security deficiencies. When you upgrade to the latest versions, you get the latest patches and fixes.
- If you use “chat rooms” or IRC sessions, be careful with any information you reveal to strangers.
- If your system starts exhibiting odd behavior, contact your ISP. Some hackers will set off hacks that cause your system to slowly become unstable or unusable.

- Always shred confidential information, particularly about your computer, before throwing it away. Some hackers dig through the trash of companies or individuals for information that might help them in an attack.

11.7 Packet Filtering Vs Firewall

Below are some comparisons between the ZyXEL Device's filtering and firewall functions.

11.7.1 Packet Filtering:

- The router filters packets as they pass through the router's interface according to the filter rules you designed.
- Packet filtering is a powerful tool, yet can be complex to configure and maintain, especially if you need a chain of rules to filter a service.
- Packet filtering only checks the header portion of an IP packet.

11.7.1.1 When To Use Filtering

- To block/allow LAN packets by their MAC addresses.
- To block/allow special IP packets which are neither TCP nor UDP, nor ICMP packets.
- To block/allow both inbound (WAN to LAN) and outbound (LAN to WAN) traffic between the specific inside host/network "A" and outside host/network "B". If the filter blocks the traffic from A to B, it also blocks the traffic from B to A. Filters can not distinguish traffic originating from an inside host or an outside host by IP address.
- To block/allow IP trace route.

11.7.2 Firewall

- The firewall inspects packet contents as well as their source and destination addresses. Firewalls of this type employ an inspection module, applicable to all protocols, that understands data in the packet is intended for other layers, from the network layer (IP headers) up to the application layer.
- The firewall performs stateful inspection. It takes into account the state of connections it handles so that, for example, a legitimate incoming packet can be matched with the outbound request for that packet and allowed in. Conversely, an incoming packet masquerading as a response to a nonexistent outbound request can be blocked.
- The firewall uses session filtering, i.e., smart rules, that enhance the filtering process and control the network session rather than control individual packets in a session.
- The firewall provides e-mail service to notify you of routine reports and when alerts occur.

11.7.2.1 When To Use The Firewall

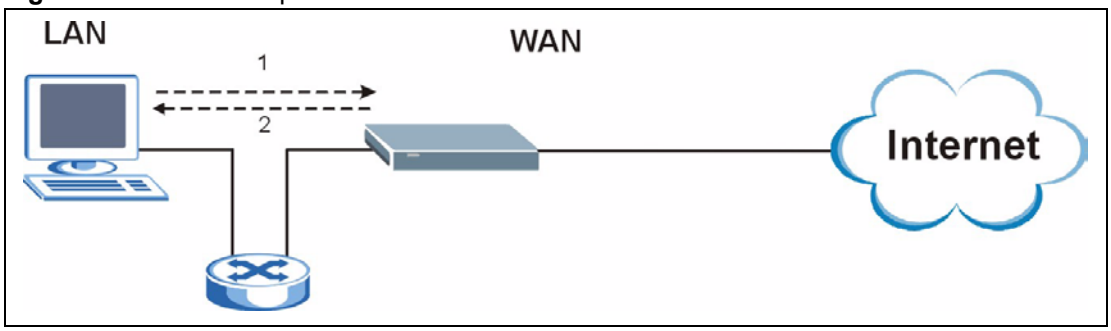
- To prevent DoS attacks and prevent hackers cracking your network.
- A range of source and destination IP addresses as well as port numbers can be specified within one firewall rule making the firewall a better choice when complex rules are required.

- To selectively block/allow inbound or outbound traffic between inside host/networks and outside host/networks. Remember that filters can not distinguish traffic originating from an inside host or an outside host by IP address.
- The firewall performs better than filtering if you need to check many rules.
- Use the firewall if you need routine e-mail reports about your system or need to be alerted when attacks occur.
- The firewall can block specific URL traffic that might occur in the future. The URL can be saved in an Access Control List (ACL) database.

11.8 Triangle Route

When the firewall is on, your switch acts as a secure gateway between your LAN and the Internet. In an ideal network topology, all incoming and outgoing network traffic passes through the switch to protect your LAN against attacks.

Figure 109 Ideal Setup



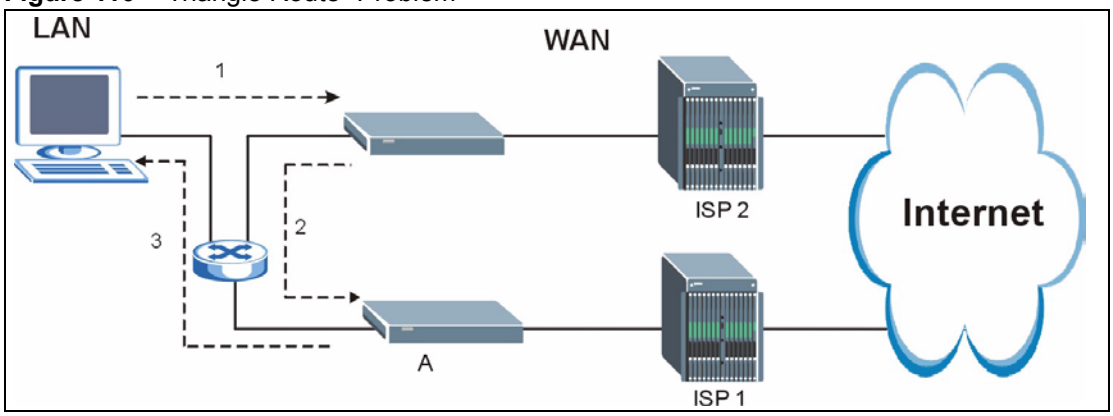
11.8.1 The "Triangle Route" Problem

A traffic route is a path for sending or receiving data packets between two Ethernet devices. Some companies have more than one route to one or more ISPs. If the alternate gateway is on the LAN (and it's IP address is in the same subnet), the "triangle route" problem may occur. The steps below describe the "triangle route" problem.

1. A computer on the LAN initiates a connection by sending out a SYN packet to a receiving server on the WAN.
2. The switch reroutes the SYN packet through Gateway **A** on the LAN to the WAN.
3. The reply from the WAN goes directly to the computer on the LAN without going through the switch.

As a result, the switch resets the connection, as the connection has not been acknowledged.

Figure 110 "Triangle Route" Problem

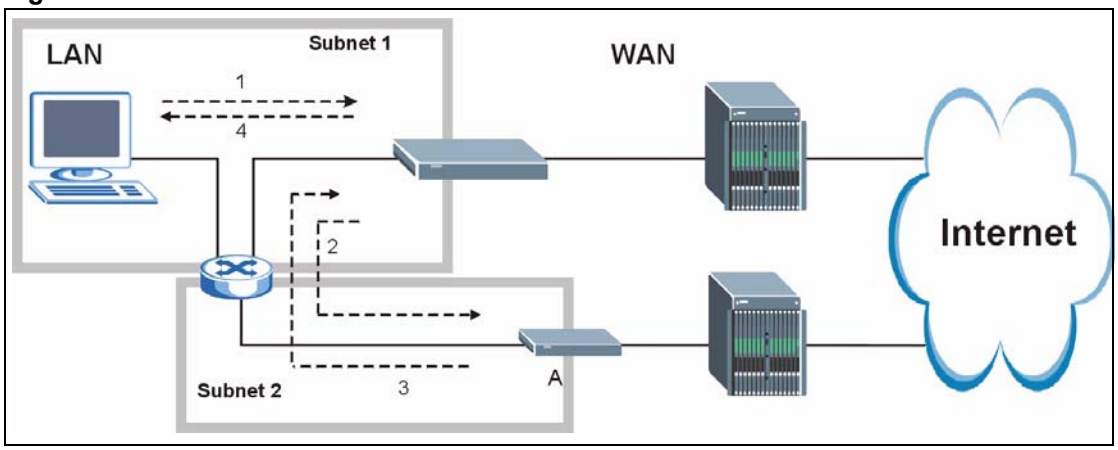


11.8.2 The "Triangle Route" Solutions

IP alias allows you to partition your network into logical sections over the same Ethernet interface. Your switch supports up to three logical LAN interfaces with the switch being the gateway for each logical network. By putting your LAN and Gateway **B** in different subnets, all returning network traffic must pass through the switch to your LAN. The following steps describe such a scenario.

1. A computer on the LAN initiates a connection by sending a SYN packet to a receiving server on the WAN.
2. The switch reroutes the packet to Gateway A, which is in Subnet 2.
3. The reply from WAN goes through the switch to the computer on the LAN in Subnet 1.

Figure 111 IP Alias



12

Firewall Configuration

This chapter shows you how to enable and configure the ZyXEL Device firewall.

12.1 Access Methods

The web configurator is, by far, the most comprehensive firewall configuration tool your ZyXEL Device has to offer. For this reason, it is recommended that you configure your firewall using the web configurator.CLI (Command Line Interpreter) commands provide limited configuration options and are only recommended for advanced users.

12.2 Firewall Policies Overview

Firewall rules are grouped based on the direction of travel of packets to which they apply:

- LAN to LAN/ Router
- LAN to WAN
- WAN to LAN
- WAN to WAN/ Router

The LAN includes both the LAN port and the WLAN.

By default, the ZyXEL Device's stateful packet inspection allows packets traveling in the following directions:

- LAN to LAN/ Router
  This allows computers on the LAN to manage the ZyXEL Device and communicate between networks or subnets connected to the LAN interface.
- LAN to WAN

By default, the ZyXEL Device's stateful packet inspection drops packets traveling in the following directions:

- WAN to LAN
- WAN to WAN/ Router
  This prevents computers on the WAN from using the ZyXEL Device as a gateway to communicate with other computers on the WAN and/or managing the ZyXEL Device.

You may define additional rules and sets or modify existing ones but please exercise extreme caution in doing so.

If you configure firewall rules without a good understanding of how they work, you might inadvertently introduce security risks to the firewall and to the protected network. Make sure you test your rules after you configure them.

For example, you may create rules to:

- Block certain types of traffic, such as IRC (Internet Relay Chat), from the LAN to the Internet.
- Allow certain types of traffic, such as Lotus Notes database synchronization, from specific hosts on the Internet to specific hosts on the LAN.
- Allow everyone except your competitors to access a Web server.
- Restrict use of certain protocols, such as Telnet, to authorized users on the LAN.

These custom rules work by comparing the Source IP address, Destination IP address and IP protocol type of network traffic to rules set by the administrator. Your customized rules take precedence and override the ZyXEL Device's default rules.

12.3 Rule Logic Overview

Study these points carefully before configuring rules.

12.3.1 Rule Checklist

State the intent of the rule. For example, "This restricts all IRC access from the LAN to the Internet." Or, "This allows a remote Lotus Notes server to synchronize over the Internet to an inside Notes server."

1. Is the intent of the rule to forward or block traffic?
2. What direction of traffic does the rule apply to?
3. What IP services will be affected?
4. What computers on the LAN are to be affected (if any)?
5. What computers on the Internet will be affected? The more specific, the better. For example, if traffic is being allowed from the Internet to the LAN, it is better to allow only certain machines on the Internet to access the LAN.

12.3.2 Security Ramifications

1. Once the logic of the rule has been defined, it is critical to consider the security ramifications created by the rule:

2 Does this rule stop LAN users from accessing critical resources on the Internet? For example, if IRC is blocked, are there users that require this service?
3 Is it possible to modify the rule to be more specific? For example, if IRC is blocked for all users, will a rule that blocks just certain users be more effective?
4 Does a rule that allows Internet users access to resources on the LAN create a security vulnerability? For example, if FTP ports (TCP 20, 21) are allowed from the Internet to the LAN, Internet users may be able to connect to computers with running FTP servers.
5 Does this rule conflict with any existing rules?
6 Once these questions have been answered, adding rules is simply a matter of plugging the information into the correct fields in the web configurator screens.

12.3.3 Key Fields For Configuring Rules

12.3.3.1 Action

Should the action be to **Drop**, **Reject** or **Permit**?

"Drop" means the firewall silently discards the packet. "Reject" means the firewall discards packets and sends an ICMP destination-unreachable message to the sender.

12.3.3.2 Service

Select the service from the **Service** scrolling list box. If the service is not listed, it is necessary to first define it. See Section 12.8 on page 187 for more information on predefined services.

12.3.3.3 Source Address

What is the connection's source address; is it on the LAN or WAN? Is it a single IP, a range of IPs or a subnet?

12.3.3.4 Destination Address

What is the connection's destination address; is it on the LAN or WAN? Is it a single IP, a range of IPs or a subnet?

12.4 Connection Direction

This section describes examples for firewall rules for connections going from LAN to WAN and from WAN to LAN.

LAN to LAN/ Router and WAN to WAN/ Router rules apply to packets coming in on the associated interface (LAN or WAN respectively). LAN to LAN/ Router means policies for LAN-to-ZyXEL Device (the policies for managing the ZyXEL Device through the LAN interface) and policies for LAN-to-LAN (the policies that control routing between two subnets on the LAN). Similarly, WAN to WAN/ Router polices apply in the same way to the WAN port.

12.4.1 LAN to WAN Rules

The default rule for LAN to WAN traffic is that all users on the LAN are allowed non-restricted access to the WAN. When you configure a LAN to WAN rule, you in essence want to limit some or all users from accessing certain services on the WAN. WAN to LAN Rules

The default rule for WAN to LAN traffic blocks all incoming connections (WAN to LAN). If you wish to allow certain WAN users to have access to your LAN, you will need to create custom rules to allow it.

12.4.2 Alerts

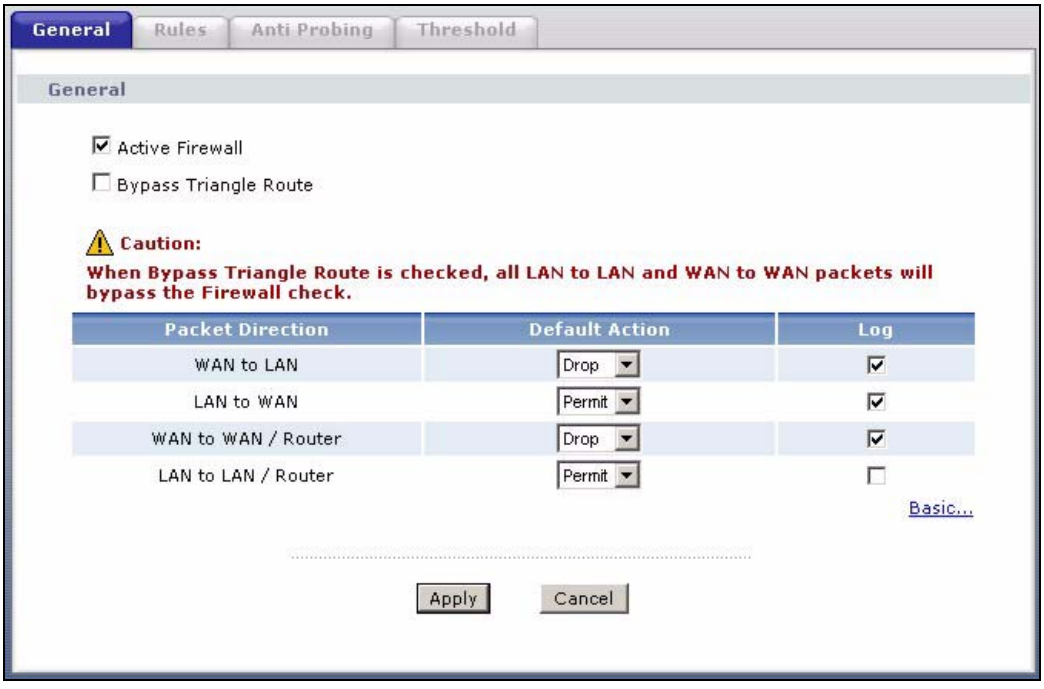
Alerts are reports on events, such as attacks, that you may want to know about right away. You can choose to generate an alert when a rule is matched in the **Edit Rule** screen (see Figure 114 on page 180). When an event generates an alert, a message can be immediately sent to an e-mail account that you specify in the **Log Settings** screen. Refer to the chapter on logs for details

12.5 General Firewall Policy

Click **Security > Firewall** to display the following screen. Activate the firewall by selecting the **Active Firewall** check box as seen in the following screen.

Refer to Section 11.1 on page 159 for more information.

Figure 112 Firewall: General



The following table describes the labels in this screen.

Table 64 Firewall: General

LABEL	DESCRIPTION
Active Firewall	Select this check box to activate the firewall. The ZyXEL Device performs access control and protects against Denial of Service (DoS) attacks when the firewall is activated.
Bypass Triangle Route	Select this check box to have the ZyXEL Device firewall permit the use of triangle route topology on the network. See the appendix for more on triangle route topology. Note: Allowing asymmetrical routes may let traffic from the WAN go directly to a LAN computer without passing through the router. See Section 11.8 on page 170 for more on triangle route topology and how to deal with this problem.
Packet Direction	This is the direction of travel of packets (**LAN to LAN / Router**, **LAN to WAN**, **WAN to WAN / Router**, **WAN to LAN**). Firewall rules are grouped based on the direction of travel of packets to which they apply. For example, **LAN to LAN / Router** means packets traveling from a computer/subnet on the LAN to either another computer/subnet on the LAN interface of the ZyXEL Device or the ZyXEL Device itself.
Default Action	Use the drop-down list boxes to select the default action that the firewall is take on packets that are traveling in the selected direction and do not match any of the firewall rules. Select **Drop** to silently discard the packets without sending a TCP reset packet or an ICMP destination-unreachable message to the sender. Select **Reject** to deny the packets and send a TCP reset packet (for a TCP packet) or an ICMP destination-unreachable message (for a UDP packet) to the sender. Select **Permit** to allow the passage of the packets.
Log	Select the check box to create a log (when the above action is taken) for packets that are traveling in the selected direction and do not match any of your customized rules.
Expand...	Click this button to display more information.
Basic...	Click this button to display less information.
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.

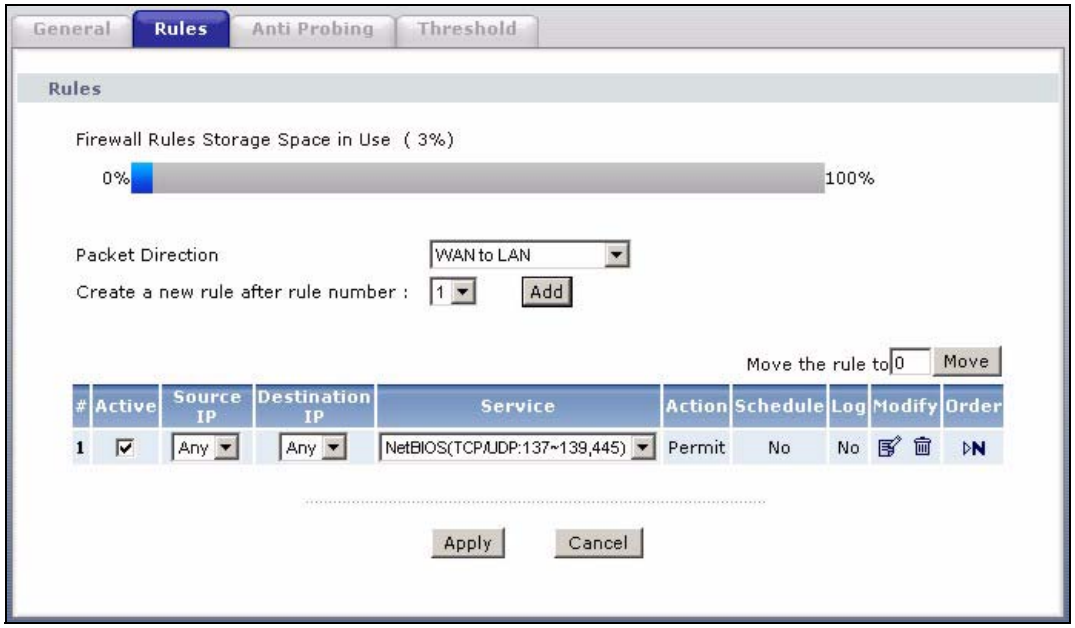
12.6 Firewall Rules Summary

The ordering of your rules is very important as rules are applied in turn.

Refer to Section 11.1 on page 159 for more information.

Click **Security > Firewall > Rules** to bring up the following screen. This screen displays a list of the configured firewall rules. Note the order in which the rules are listed.

Figure 113 Firewall Rules



The following table describes the labels in this screen.

Table 65 Firewall Rules

LABEL	DESCRIPTION
Firewall Rules Storage Space in Use	This read-only bar shows how much of the ZyXEL Device's memory for recording firewall rules it is currently using. When you are using 80% or less of the storage space, the bar is green. When the amount of space used is over 80%, the bar is red.
Packet Direction	Use the drop-down list box to select a direction of travel of packets for which you want to configure firewall rules.
Create a new rule after rule number	Select an index number and click **Add** to add a new firewall rule after the selected index number. For example, if you select “6”, your new rule becomes number 7 and the previous rule 7 (if there is one) becomes rule 8.
	The following fields summarize the rules you have created that apply to traffic traveling in the selected packet direction. The firewall rules that you configure (summarized below) take priority over the general firewall action settings in the **General** screen.
#	This is your firewall rule number. The ordering of your rules is important as rules are applied in turn.
Active	This field displays whether a firewall is turned on or not. Select the check box to enable the rule. Clear the check box to disable the rule.
Source IP	This drop-down list box displays the source addresses or ranges of addresses to which this firewall rule applies. Please note that a blank source or destination address is equivalent to **Any**.
Destination IP	This drop-down list box displays the destination addresses or ranges of addresses to which this firewall rule applies. Please note that a blank source or destination address is equivalent to **Any**.
Service	This drop-down list box displays the services to which this firewall rule applies. See Section 12.8 on page 187 for more information.

Table 65 Firewall Rules (continued)

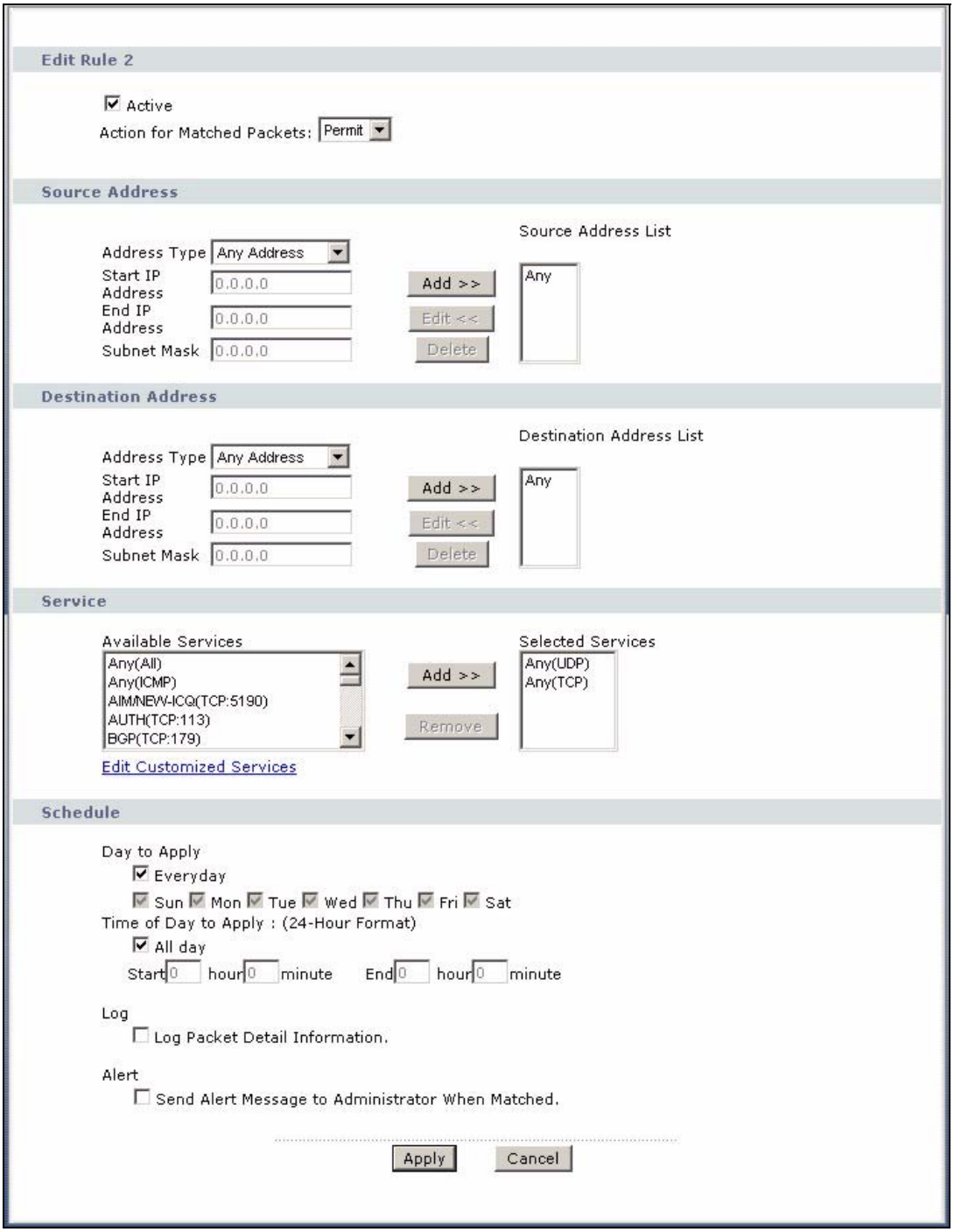
LABEL	DESCRIPTION
Action	This field displays whether the firewall silently discards packets (**Drop**), discards packets and sends a TCP reset packet or an ICMP destination-unreachable message to the sender (**Reject**) or allows the passage of packets (**Permit**)
Schedule	This field tells you whether a schedule is specified (**Yes**) or not (**No**).
Log	This field shows you whether a log is created when packets match this rule (**Yes**) or not (**No**).
Modify	Click the Edit icon to go to the screen where you can edit the rule. Click the Remove icon to delete an existing firewall rule. A window displays asking you to confirm that you want to delete the firewall rule. Note that subsequent firewall rules move up by one when you take this action.
Order	Click the Move icon to display the **Move the rule to** field. Type a number in the **Move the rule to** field and click the **Move** button to move the rule to the number that you typed. The ordering of your rules is important as they are applied in order of their numbering.
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.

12.6.1 Configuring Firewall Rules

Refer to Section 11.1 on page 159 for more information.

In the **Rules** screen, select an index number and click **Add** or click a rule's Edit icon to display this screen and refer to the following table for information on the labels.

Figure 114 Firewall: Edit Rule



The following table describes the labels in this screen.

Table 66 Firewall: Edit Rule

LABEL	DESCRIPTION
Edit Rule N	
Active	Select this option to enable this firewall rule.

Table 66 Firewall: Edit Rule (continued)

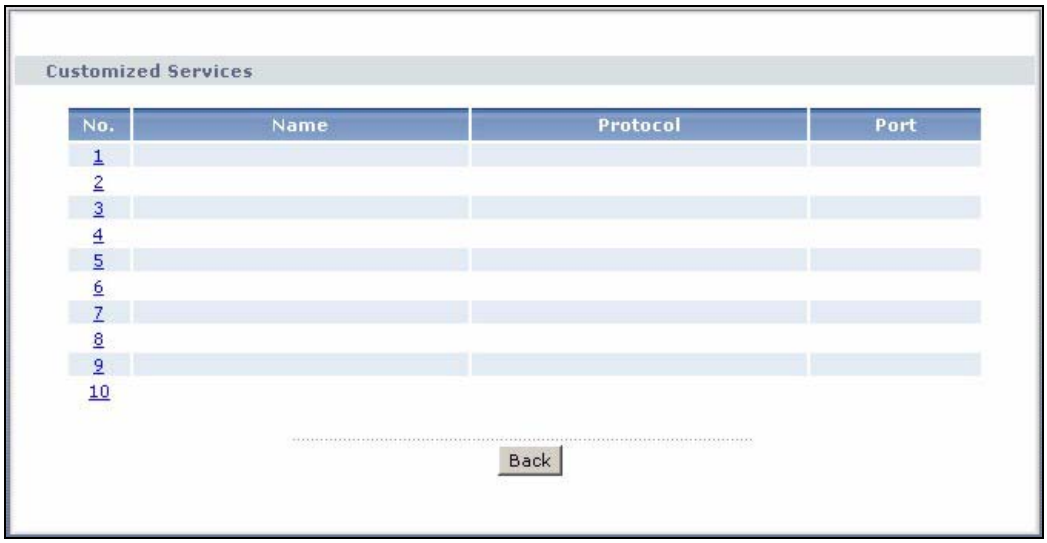
LABEL	DESCRIPTION
Action for Matched Packet	Use the drop-down list box to select what the firewall is to do with packets that match this rule. Select **Drop** to silently discard the packets without sending a TCP reset packet or an ICMP destination-unreachable message to the sender. Select **Reject** to deny the packets and send a TCP reset packet (for a TCP packet) or an ICMP destination-unreachable message (for a UDP packet) to the sender. Select **Permit** to allow the passage of the packets.
Source/Destination Address	
Address Type	Do you want your rule to apply to packets with a particular (single) IP, a range of IP addresses (e.g., 192.168.1.10 to 192.169.1.50), a subnet or any IP address? Select an option from the drop-down list box that includes: **Single Address**, **Range Address**, **Subnet Address** and **Any Address**.
Start IP Address	Enter the single IP address or the starting IP address in a range here.
End IP Address	Enter the ending IP address in a range here.
Subnet Mask	Enter the subnet mask here, if applicable.
Add >>	Click **Add >>** to add a new address to the **Source** or **Destination Address** box. You can add multiple addresses, ranges of addresses, and/or subnets.
Edit <<	To edit an existing source or destination address, select it from the box and click **Edit <<**.
Delete	Highlight an existing source or destination address from the **Source** or **Destination Address** box above and click **Delete** to remove it.
Services	
Available/ Selected Services	Please see Section 12.8 on page 187 for more information on services available. Highlight a service from the **Available Services** box on the left, then click **Add >>** to add it to the **Selected Services** box on the right. To remove a service, highlight it in the **Selected Services** box on the right, then click **Remove**.
Edit Customized Service	Click the **Edit Customized Services** link to bring up the screen that you use to configure a new custom service that is not in the predefined list of services.
Schedule	
Day to Apply	Select everyday or the day(s) of the week to apply the rule.
Time of Day to Apply (24-Hour Format)	Select **All Day** or enter the start and end times in the hour-minute format to apply the rule.
Log	
Log Packet Detail Information	This field determines if a log for packets that match the rule is created or not. Go to the **Log Settings** page and select the **Access Control** logs category to have the ZyXEL Device record these logs.
Alert	
Send Alert Message to Administrator When Matched	Select the check box to have the ZyXEL Device generate an alert when the rule is matched.
Apply	Click **Apply** to save your customized settings and exit this screen.
Cancel	Click **Cancel** to exit this screen without saving.

12.6.2 Customized Services

Configure customized services and port numbers not predefined by the ZyXEL Device. For a comprehensive list of port numbers and services, visit the IANA (Internet Assigned Number Authority) website. For further information on these services, please read Section 12.8 on page 187. Click the **Edit Customized Services** link while editing a firewall rule to configure a custom service port. This displays the following screen.

Refer to Section 11.1 on page 159 for more information.

Figure 115 Firewall: Customized Services



The following table describes the labels in this screen.

Table 67 Customized Services

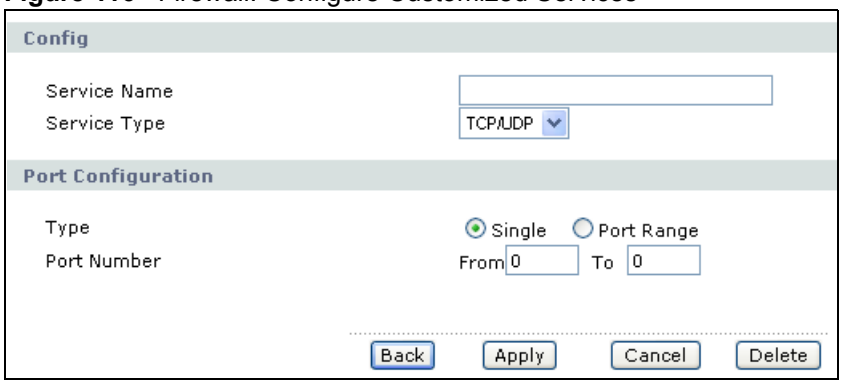
LABEL	DESCRIPTION
No.	This is the number of your customized port. Click a rule's number of a service to go to a screen where you can configure or edit a customized service. See Section 12.6.3 on page 182 for more information.
Name	This is the name of your customized service.
Protocol	This shows the IP protocol (**TCP**, **UDP** or **TCP/UDP**) that defines your customized service.
Port	This is the port number or range that defines your customized service.
Back	Click **Back** to return the **Firewall Edit Rule** screen.

12.6.3 Configuring a Customized Service

Click a rule number in the **Firewall Customized Services** screen to create a new custom port or edit an existing one. This action displays the following screen.

Refer to Section 11.1 on page 159 for more information.

Figure 116 Firewall: Configure Customized Services



The following table describes the labels in this screen.

Table 68 Firewall: Configure Customized Services

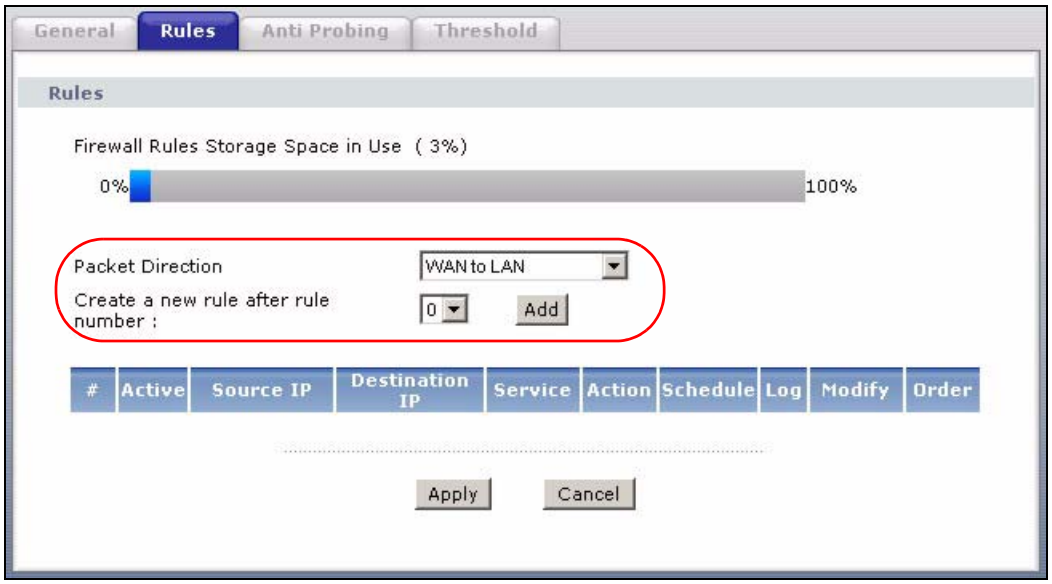
LABEL	DESCRIPTION
Config	
Service Name	Type a unique name for your custom port.
Service Type	Choose the IP port (**TCP**, **UDP** or **TCP/UDP**) that defines your customized port from the drop down list box.
Port Configuration	
Type	Click **Single** to specify one port only or **Range** to specify a span of ports that define your customized service.
Port Number	Type a single port number or the range of port numbers that define your customized service.
Back	Click **Back** to return to the previous screen.
Apply	Click **Apply** to save your customized settings and exit this screen.
Cancel	Click **Cancel** to begin configuring this screen afresh.
Delete	Click **Delete** to delete the current rule and return to the previous screen.

12.7 Example Firewall Rule

The following Internet firewall rule example allows a hypothetical “MyService” connection from the Internet.

1. Click **Security > Firewall** > **Rules**.
2. Select **WAN to LAN** in the **Packet Direction** field.

Figure 117 Firewall Example: Rules



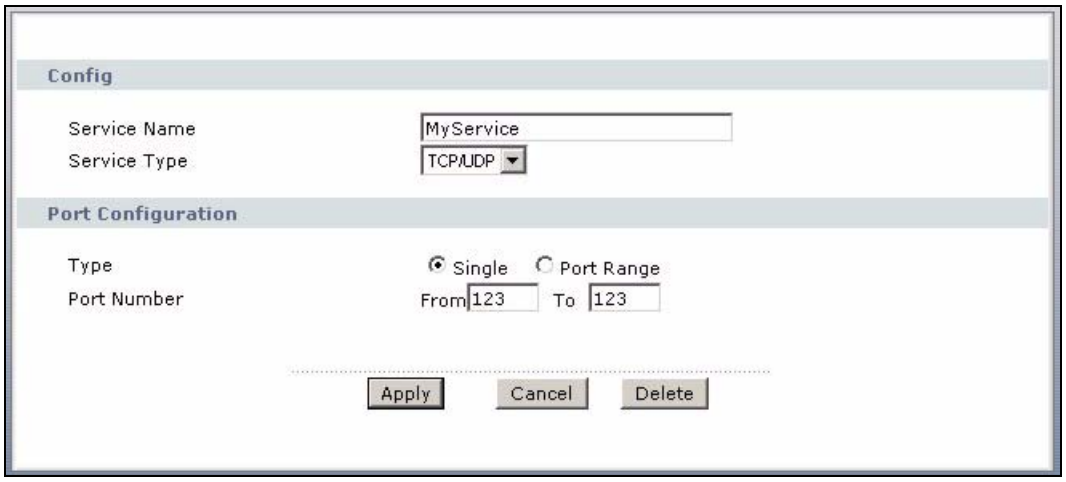
3 In the **Rules** screen, select the index number after that you want to add the rule. For example, if you select "6", your new rule becomes number 7 and the previous rule 7 (if there is one) becomes rule 8.

4 Click **Add** to display the firewall rule configuration screen.

5 In the **Edit Rule** screen, click the **Edit Customized Services** link to open the **Customized Service** screen.

6 Click an index number to display the **Customized Services Config** screen and configure the screen as follows and click **Apply**.

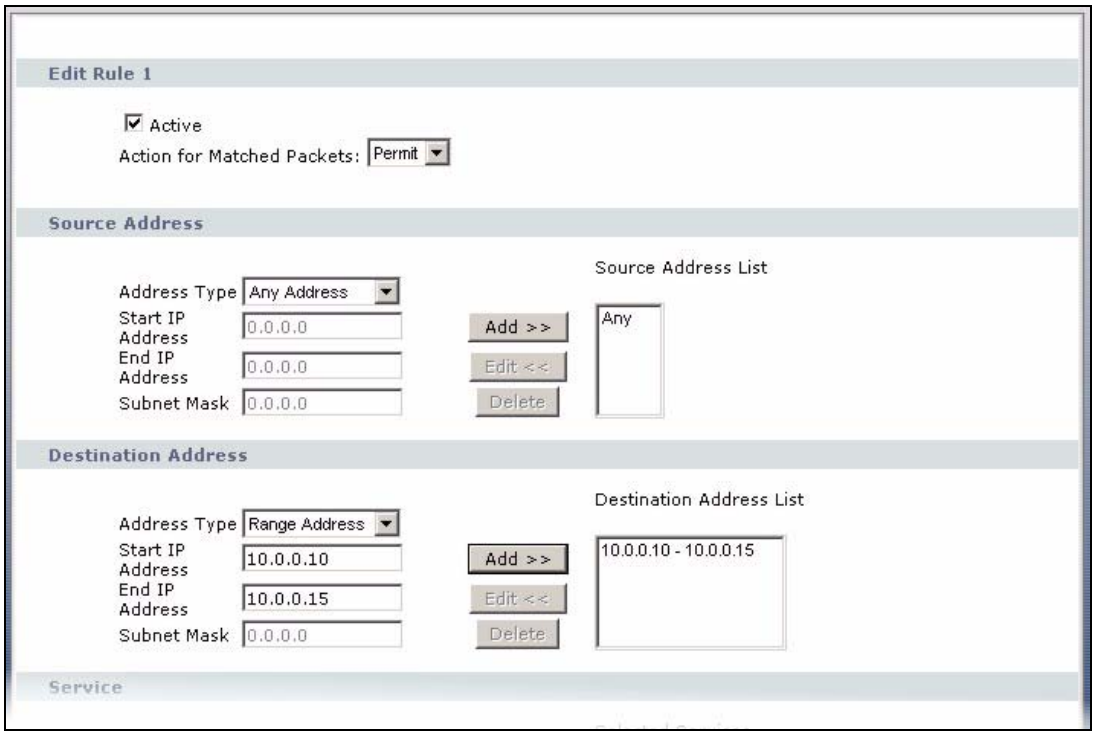
Figure 118 Edit Custom Port Example



7 Select **Any** in the **Destination Address** box and then click **Delete**.

8 Configure the destination address screen as follows and click **Add**.

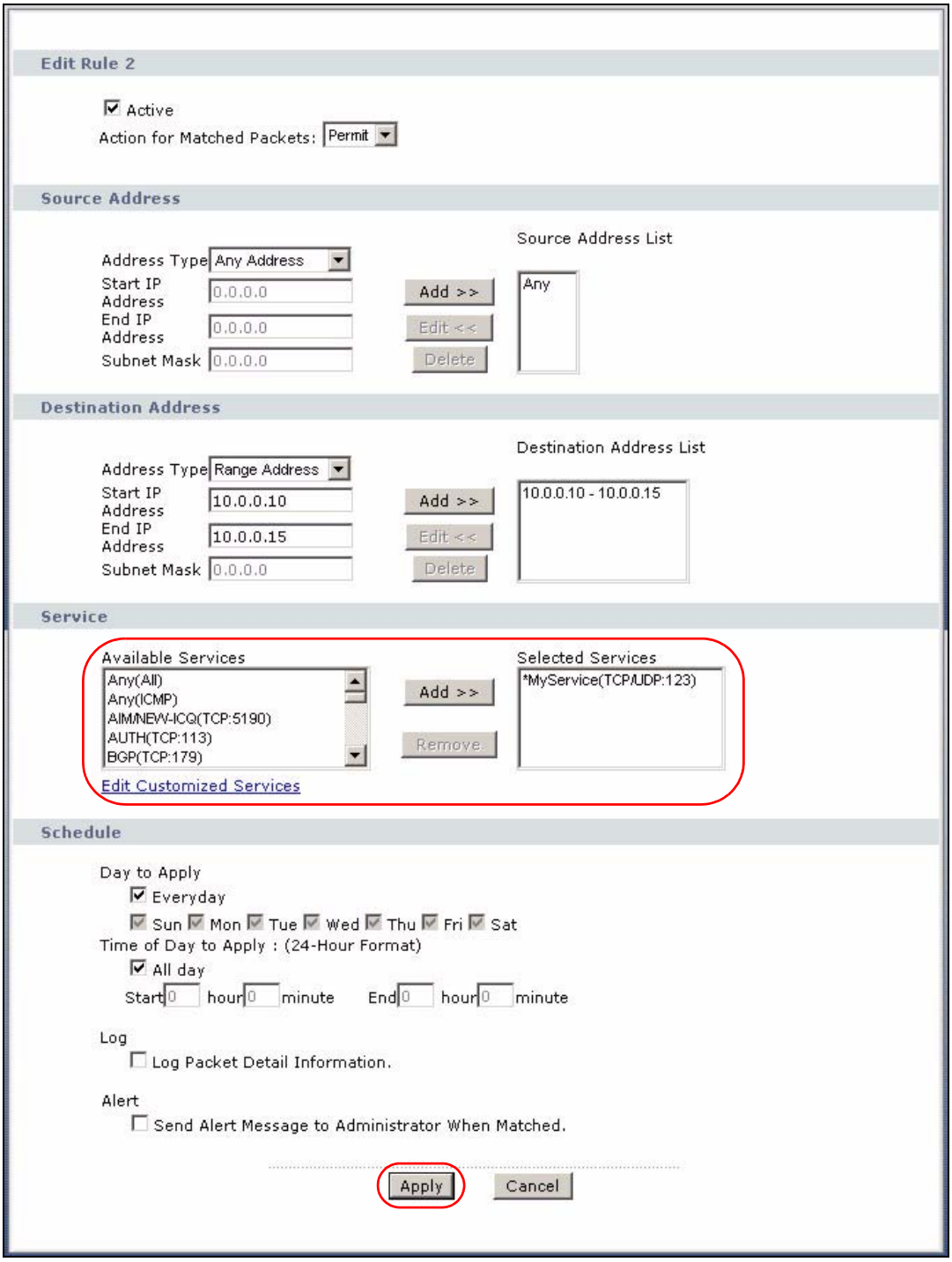
Figure 119 Firewall Example: Edit Rule: Destination Address



9 Use the **Add >>** and **Remove** buttons between **Available Services** and **Selected Services** list boxes to configure it as follows. Click **Apply** when you are done.

Custom services show up with an "*" before their names in the **Services** list box and the **Rules** list box.

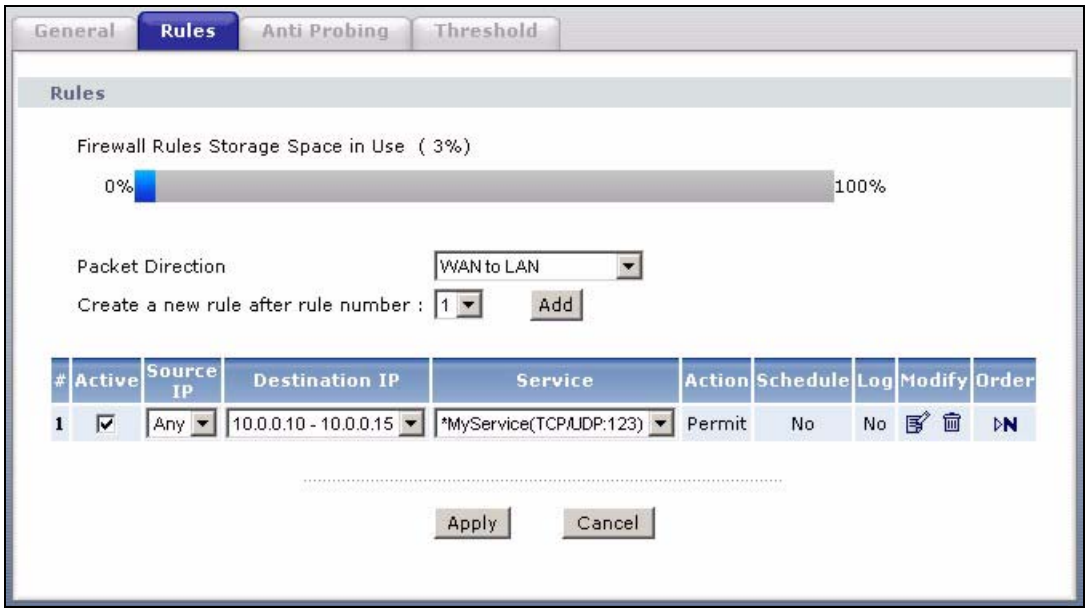
Figure 120 Firewall Example: Edit Rule: Select Customized Services



On completing the configuration procedure for this Internet firewall rule, the **Rules** screen should look like the following.

Rule 1 allows a “MyService” connection from the WAN to IP addresses 10.0.0.10 through 10.0.0.15 on the LAN.

Figure 121 Firewall Example: Rules: MyService



12.8 Predefined Services

The **Available Services** list box in the **Edit Rule** screen (see Section 12.6.1 on page 179) displays all predefined services that the ZyXEL Device already supports. Next to the name of the service, two fields appear in brackets. The first field indicates the IP protocol type (TCP, UDP, or ICMP). The second field indicates the IP port number that defines the service. (Note that there may be more than one IP protocol type. For example, look at the default configuration labeled "(**DNS**)". **(UDP/TCP:53)** means UDP port 53 and TCP port 53. Up to 128 entries are supported. Custom service ports may also be configured using the **Edit Customized Services** function discussed previously.

Table 69 Predefined Services

SERVICE	DESCRIPTION
AIM/NEW_ICQ(TCP:5190)	AOL's Internet Messenger service, used as a listening port by ICQ.
AUTH(TCP:113)	Authentication protocol used by some servers.
BGP(TCP:179)	Border Gateway Protocol.
BOOTP_CLIENT(UDP:68)	DHCP Client.
BOOTP_SERVER(UDP:67)	DHCP Server.
CU-SEEME(TCP/UDP:7648, 24032)	A popular videoconferencing solution from White Pines Software.
DNS(UDP/TCP:53)	Domain Name Server, a service that matches web names (e.g. www.zyxel.com) to IP numbers.
FINGER(TCP:79)	Finger is a UNIX or Internet related command that can be used to find out if a user is logged on.
FTP(TCP:20.21)	File Transfer Program, a program to enable fast transfer of files, including large files that may not be possible by e-mail.
H.323(TCP:1720)	Net Meeting uses this protocol.

Table 69 Predefined Services (continued)

SERVICE	DESCRIPTION
HTTP(TCP:80)	Hyper Text Transfer Protocol - a client/server protocol for the world wide web.
HTTPS	HTTPS is a secured http session often used in e-commerce.
ICQ(UDP:4000)	This is a popular Internet chat program.
IPSEC_TRANSPORT/ TUNNEL(AH:0)	The IPSEC AH (Authentication Header) tunneling protocol uses this service.
IPSEC_TUNNEL(ESP:0)	The IPSEC ESP (Encapsulation Security Protocol) tunneling protocol uses this service.
IRC(TCP/UDP:6667)	This is another popular Internet chat program.
MSN Messenger(TCP:1863)	Microsoft Networks' messenger service uses this protocol.
MULTICAST(IGMP:0)	Internet Group Management Protocol is used when sending packets to a specific group of hosts.
NEWS(TCP:144)	A protocol for news groups.
NFS(UDP:2049)	Network File System - NFS is a client/server distributed file service that provides transparent file-sharing for network environments.
NNTP(TCP:119)	Network News Transport Protocol is the delivery mechanism for the USENET newsgroup service.
PING(ICMP:0)	Packet INternet Groper is a protocol that sends out ICMP echo requests to test whether or not a remote host is reachable.
POP3(TCP:110)	Post Office Protocol version 3 lets a client computer get e-mail from a POP3 server through a temporary connection (TCP/IP or other).
PPTP(TCP:1723)	Point-to-Point Tunneling Protocol enables secure transfer of data over public networks. This is the control channel.
PPTP_TUNNEL(GRE:0)	Point-to-Point Tunneling Protocol enables secure transfer of data over public networks. This is the data channel.
RCMD(TCP:512)	Remote Command Service.
REAL_AUDIO(TCP:7070)	A streaming audio service that enables real time sound over the web.
REXEC(TCP:514)	Remote Execution Daemon.
RLOGIN(TCP:513)	Remote Login.
RTELNET(TCP:107)	Remote Telnet.
RTSP(TCP/UDP:554)	The Real Time Streaming (media control) Protocol (RTSP) is a remote control for multimedia on the Internet.
SFTP(TCP:115)	Simple File Transfer Protocol.
SMTP(TCP:25)	Simple Mail Transfer Protocol is the message-exchange standard for the Internet. SMTP enables you to move messages from one e-mail server to another.
SNMP(TCP/UDP:161)	Simple Network Management Program.
SNMP-TRAPS (TCP/ UDP:162)	Traps for use with the SNMP (RFC:1215).
SQL-NET(TCP:1521)	Structured Query Language is an interface to access data on many different types of database systems, including mainframes, midrange systems, UNIX systems and network servers.
SSDP(UDP:1900)	Simole Service Discovery Protocol (SSDP) is a discovery service searching for Universal Plug and Play devices on your home network or upstream Internet gateways using DUDP port 1900.

Table 69 Predefined Services (continued)

SERVICE	DESCRIPTION
SSH(TCP/UDP:22)	Secure Shell Remote Login Program.
STRMWORKS(UDP:1558)	Stream Works Protocol.
SYSLOG(UDP:514)	Syslog allows you to send system logs to a UNIX server.
TACACS(UDP:49)	Login Host Protocol used for (Terminal Access Controller Access Control System).
TELNET(TCP:23)	Telnet is the login and terminal emulation protocol common on the Internet and in UNIX environments. It operates over TCP/IP networks. Its primary function is to allow users to log into remote host systems.
TFTP(UDP:69)	Trivial File Transfer Protocol is an Internet file transfer protocol similar to FTP, but uses the UDP (User Datagram Protocol) rather than TCP (Transmission Control Protocol).
VDOLIVE(TCP:7000)	Another videoconferencing solution.

12.9 Anti-Probing

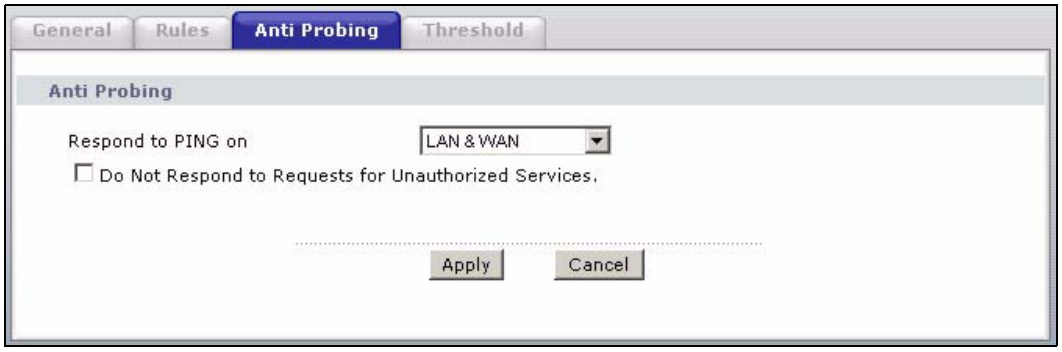
If an outside user attempts to probe an unsupported port on your ZyXEL Device, an ICMP response packet is automatically returned. This allows the outside user to know the ZyXEL Device exists. The ZyXEL Device supports anti-probing, which prevents the ICMP response packet from being sent. This keeps outsiders from discovering your ZyXEL Device when unsupported ports are probed.

Internet Control Message Protocol (ICMP) is a message control and error-reporting protocol between a host server and a gateway to the Internet. ICMP uses Internet Protocol (IP) datagrams, but the messages are processed by the TCP/IP software and directly apparent to the application user.

Refer to Section 11.1 on page 159 for more information.

Click **Security > Firewall > Anti Probing** to display the screen as shown.

Figure 122 Firewall: Anti Probing



The following table describes the labels in this screen.

Table 70 Firewall: Anti Probing

LABEL	DESCRIPTION
Respond to PING on	The ZyXEL Device does not respond to any incoming Ping requests when **Disable** is selected. Select **LAN** to reply to incoming LAN Ping requests. Select **WAN** to reply to incoming WAN Ping requests. Otherwise select **LAN & WAN** to reply to both incoming LAN and WAN Ping requests.
Do Not Respond to Requests for Unauthorized Services.	Select this option to prevent hackers from finding the ZyXEL Device by probing for unused ports. If you select this option, the ZyXEL Device will not respond to port request(s) for unused ports, thus leaving the unused ports and the ZyXEL Device unseen. By default this option is not selected and the ZyXEL Device will reply with an ICMP Port Unreachable packet for a port probe on its unused UDP ports, and a TCP Reset packet for a port probe on its unused TCP ports. Note that the probing packets must first traverse the ZyXEL Device's firewall mechanism before reaching this anti-probing mechanism. Therefore if the firewall mechanism blocks a probing packet, the ZyXEL Device reacts based on the corresponding firewall policy to send a TCP reset packet for a blocked TCP packet or an ICMP port-unreachable packet for a blocked UDP packets or just drop the packets without sending a response packet.
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.

12.10 DoS Thresholds

For DoS attacks, the ZyXEL Device uses thresholds to determine when to drop sessions that do not become fully established. These thresholds apply globally to all sessions.

You can use the default threshold values, or you can change them to values more suitable to your security requirements.

Refer to Section 12.10.3 on page 191 to configure thresholds.

12.10.1 Threshold Values

Tune these parameters when something is not working and after you have checked the firewall counters. These default values should work fine for most small offices. Factors influencing choices for threshold values are:

- The maximum number of opened sessions.
- The minimum capacity of server backlog in your LAN network.
- The CPU power of servers in your LAN network.
- Network bandwidth.
- Type of traffic for certain servers.

If your network is slower than average for any of these factors (especially if you have servers that are slow or handle many tasks and are often busy), then the default values should be reduced.

You should make any changes to the threshold values before you continue configuring firewall rules.

12.10.2 Half-Open Sessions

An unusually high number of half-open sessions (either an absolute number or measured as the arrival rate) could indicate that a Denial of Service attack is occurring. For TCP, "half-open" means that the session has not reached the established state-the TCP three-way handshake has not yet been completed (see Figure 105 on page 162). For UDP, "half-open" means that the firewall has detected no return traffic.

The ZyXEL Device measures both the total number of existing half-open sessions and the rate of session establishment attempts. Both TCP and UDP half-open sessions are counted in the total number and rate measurements. Measurements are made once a minute.

When the number of existing half-open sessions rises above a threshold (**max-incomplete high**), the ZyXEL Device starts deleting half-open sessions as required to accommodate new connection requests. The ZyXEL Device continues to delete half-open requests as necessary, until the number of existing half-open sessions drops below another threshold (**max-incomplete low**).

When the rate of new connection attempts rises above a threshold (**one-minute high**), the ZyXEL Device starts deleting half-open sessions as required to accommodate new connection requests. The ZyXEL Device continues to delete half-open sessions as necessary, until the rate of new connection attempts drops below another threshold (**one-minute low**). The rate is the number of new attempts detected in the last one-minute sample period.

12.10.2.1 TCP Maximum Incomplete and Blocking Time

An unusually high number of half-open sessions with the same destination host address could indicate that a Denial of Service attack is being launched against the host.

Whenever the number of half-open sessions with the same destination host address rises above a threshold (**TCP Maximum Incomplete**), the ZyXEL Device starts deleting half-open sessions according to one of the following methods:

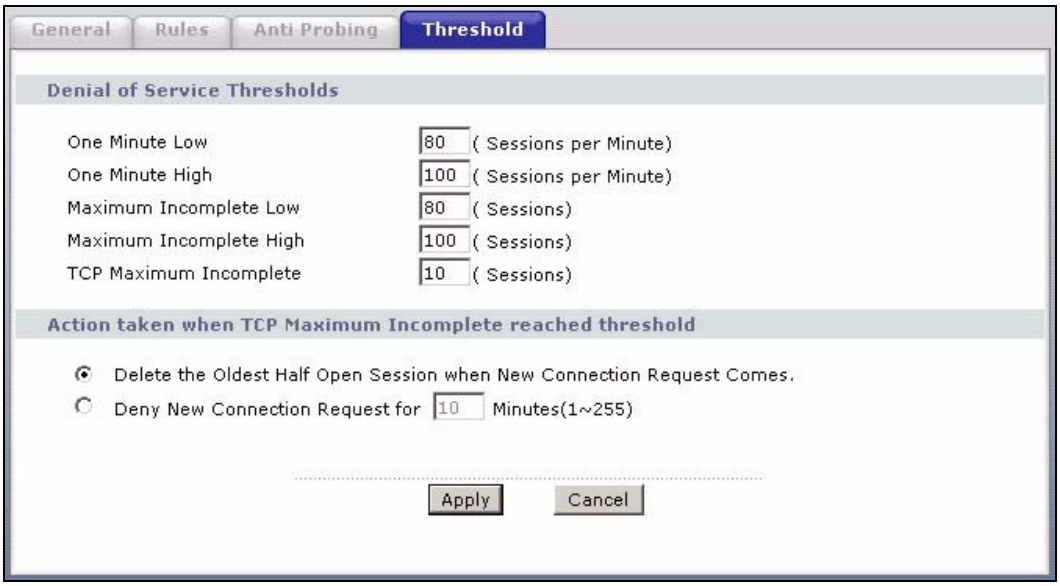
- If the **Blocking Time** timeout is 0 (the default), then the ZyXEL Device deletes the oldest existing half-open session for the host for every new connection request to the host. This ensures that the number of half-open sessions to a given host will never exceed the threshold.
- If the **Blocking Time** timeout is greater than 0, then the ZyXEL Device blocks all new connection requests to the host giving the server time to handle the present connections. The ZyXEL Device continues to block all new connection requests until the **Blocking Time** expires.

12.10.3 Configuring Firewall Thresholds

The ZyXEL Device also sends alerts whenever **TCP Maximum Incomplete** is exceeded. The global values specified for the threshold and timeout apply to all TCP connections.

Click **Firewall**, and **Threshold** to bring up the next screen.

Figure 123 Firewall: Threshold



The following table describes the labels in this screen.

Table 71 Firewall: Threshold

LABEL	DESCRIPTION	DEFAULT VALUES
Denial of Service Thresholds		
One Minute Low	This is the rate of new half-open sessions that causes the firewall to stop deleting half-open sessions. The ZyXEL Device continues to delete half-open sessions as necessary, until the rate of new connection attempts drops below this number.	80 existing half-open sessions.
One Minute High	This is the rate of new half-open sessions that causes the firewall to start deleting half-open sessions. When the rate of new connection attempts rises above this number, the ZyXEL Device deletes half-open sessions as required to accommodate new connection attempts.	100 half-open sessions per minute. The above numbers cause the ZyXEL Device to start deleting half-open sessions when more than 100 session establishment attempts have been detected in the last minute, and to stop deleting half-open sessions when fewer than 80 session establishment attempts have been detected in the last minute.
Maximum Incomplete Low	This is the number of existing half-open sessions that causes the firewall to stop deleting half-open sessions. The ZyXEL Device continues to delete half-open requests as necessary, until the number of existing half-open sessions drops below this number.	80 existing half-open sessions.

Table 71 Firewall: Threshold (continued)

LABEL	DESCRIPTION	DEFAULT VALUES
Maximum Incomplete High	This is the number of existing half-open sessions that causes the firewall to start deleting half-open sessions. When the number of existing half-open sessions rises above this number, the ZyXEL Device deletes half-open sessions as required to accommodate new connection requests. Do not set **Maximum Incomplete High** to lower than the current **Maximum Incomplete Low** number.	100 existing half-open sessions. The above values causes the ZyXEL Device to start deleting half-open sessions when the number of existing half-open sessions rises above 100, and to stop deleting half-open sessions with the number of existing half-open sessions drops below 80.
TCP Maximum Incomplete	This is the number of existing half-open TCP sessions with the same destination host IP address that causes the firewall to start dropping half-open sessions to that same destination host IP address. Enter a number between 1 and 256. As a general rule, you should choose a smaller number for a smaller network, a slower system or limited bandwidth.	10 existing half-open TCP sessions.
Action taken when TCP Maximum Incomplete threshold is reached.		
Delete the Oldest Half Open Session when New Connection Request Comes	Select this radio button to clear the oldest half open session when a new connection request comes.	
Deny New Connection Request for	Select this radio button and specify for how long the ZyXEL Device should block new connection requests when **TCP Maximum Incomplete** is reached. Enter the length of blocking time in minutes (between 1 and 255).	
Apply	Click **Apply** to save your changes to the ZyXEL Device.	
Cancel	Click **Cancel** to begin configuring this screen afresh.	

13

Content Filtering

This chapter covers how to configure content filtering.

13.1 Content Filtering Overview

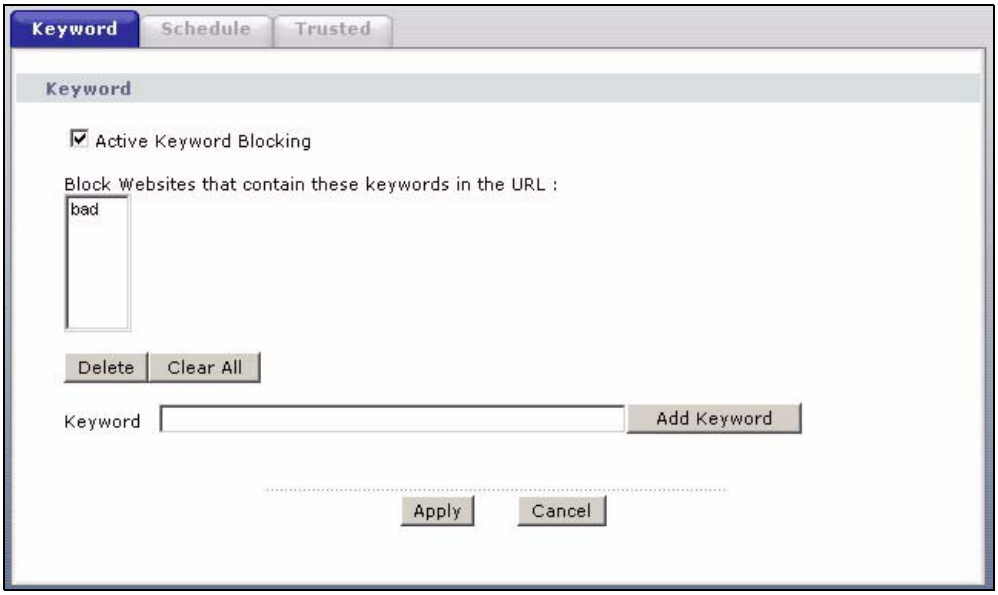
Internet content filtering allows you to create and enforce Internet access policies tailored to your needs. Content filtering gives you the ability to block web sites that contain key words (that you specify) in the URL. You can set a schedule for when the ZyXEL Device performs content filtering. You can also specify trusted IP addresses on the LAN for which the ZyXEL Device will not perform content filtering.

13.2 Configuring Keyword Blocking

Use this screen to block sites containing certain keywords in the URL. For example, if you enable the keyword "bad", the ZyXEL Device blocks all sites containing this keyword including the URL http://www.website.com/bad.html, even if it is not included in the Filter List.

To have your ZyXEL Device block Web sites containing keywords in their URLs, click **Security > Content Filter**. The screen appears as shown.

Figure 124 Content Filter: Keyword



The following table describes the labels in this screen.

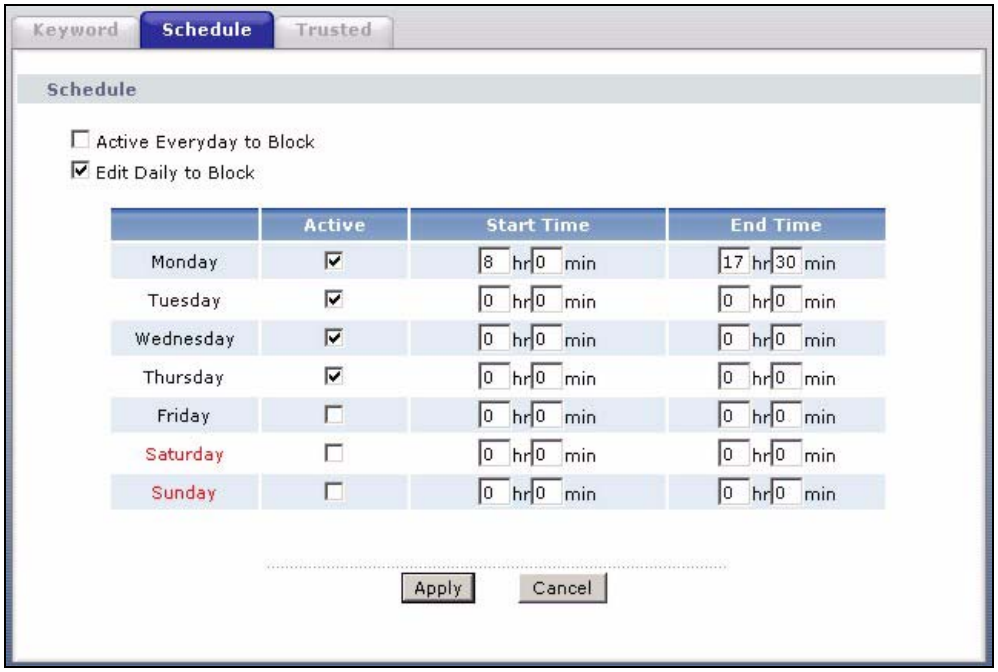
Table 72 Content Filter: Keyword

LABEL	DESCRIPTION
Active Keyword Blocking	Select this check box to enable this feature.
Block Websites that contain these keywords in the URL:	This box contains the list of all the keywords that you have configured the ZyXEL Device to block.
Delete	Highlight a keyword in the box and click **Delete** to remove it.
Clear All	Click **Clear All** to remove all of the keywords from the list.
Keyword	Type a keyword in this field. You may use any character (up to 127 characters). Wildcards are not allowed.
Add Keyword	Click **Add Keyword** after you have typed a keyword. Repeat this procedure to add other keywords. Up to 64 keywords are allowed. When you try to access a web page containing a keyword, you will get a message telling you that the content filter is blocking this request.
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Cancel	Click **Cancel** to return to the previously saved settings.

13.3 Configuring the Schedule

To set the days and times for the ZyXEL Device to perform content filtering, click **Security** > **Content Filter** > **Schedule**. The screen appears as shown.

Figure 125 Content Filter: Schedule



The following table describes the labels in this screen.

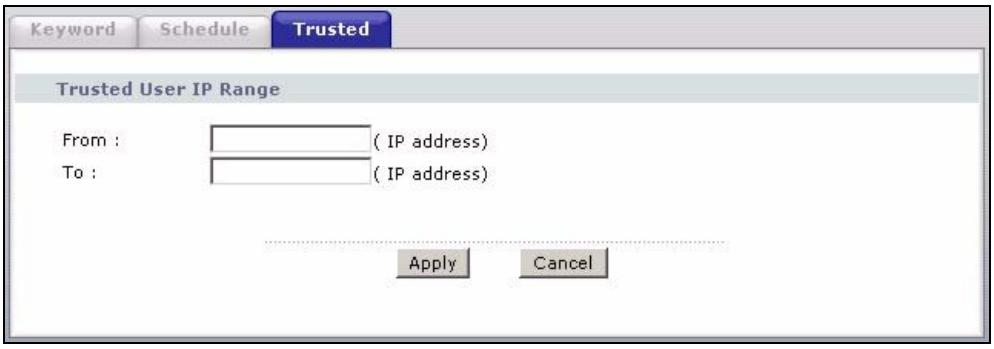
Table 73 Content Filter: Schedule

LABEL	DESCRIPTION
Schedule	Select **Active Everyday to Block** to make the content filtering active everyday. Otherwise, select **Edit Daily to Block** and configure which days of the week (or everyday) and which time of the day you want the content filtering to be active.
Active	Select the check box to have the content filtering active on the selected day.
Start TIme	Enter the start time when you want the content filtering to take effect in hour-minute format.
End Time	Enter the end time when you want the content filtering to stop in hour-minute format.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to return to the previously saved settings.

13.4 Configuring Trusted Computers

To exclude a range of users on the LAN from content filtering on your ZyXEL Device, click **Security > Content Filter** > **Trusted**. The screen appears as shown.

Figure 126 Content Filter: Trusted



The following table describes the labels in this screen.

Table 74 Content Filter: Trusted

LABEL	DESCRIPTION
Trusted User IP Range	
From	Type the IP address of a computer (or the beginning IP address of a specific range of computers) on the LAN that you want to exclude from content filtering.
To	Type the ending IP address of a specific range of users on your LAN that you want to exclude from content filtering. Leave this field blank if you want to exclude an individual computer.
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Cancel	Click **Cancel** to return to the previously saved settings.

PART V
Advanced

Static Route (201)
Bandwidth Management (205)
Dynamic DNS Setup (217)
Remote Management Configuration (221)
Universal Plug-and-Play (UPnP) (233)

14

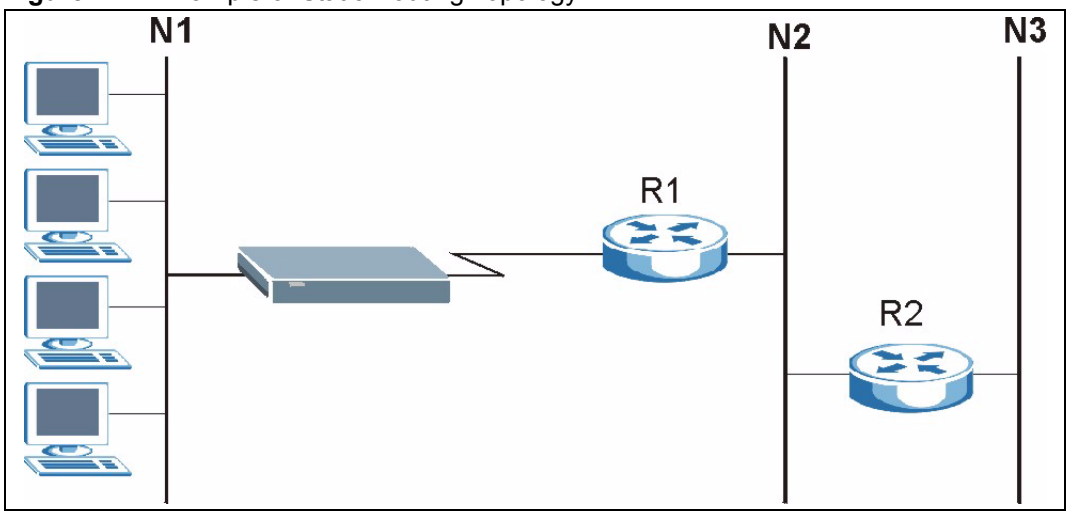
Static Route

This chapter shows you how to configure static routes for your ZyXEL Device.

14.1 Static Route

Each remote node specifies only the network to which the gateway is directly connected, and the ZyXEL Device has no knowledge of the networks beyond. For instance, the ZyXEL Device knows about network N2 in the following figure through remote node Router 1. However, the ZyXEL Device is unable to route a packet to network N3 because it doesn't know that there is a route through the same remote node Router 1 (via gateway Router 2). The static routes are for you to tell the ZyXEL Device about the networks beyond the remote nodes.

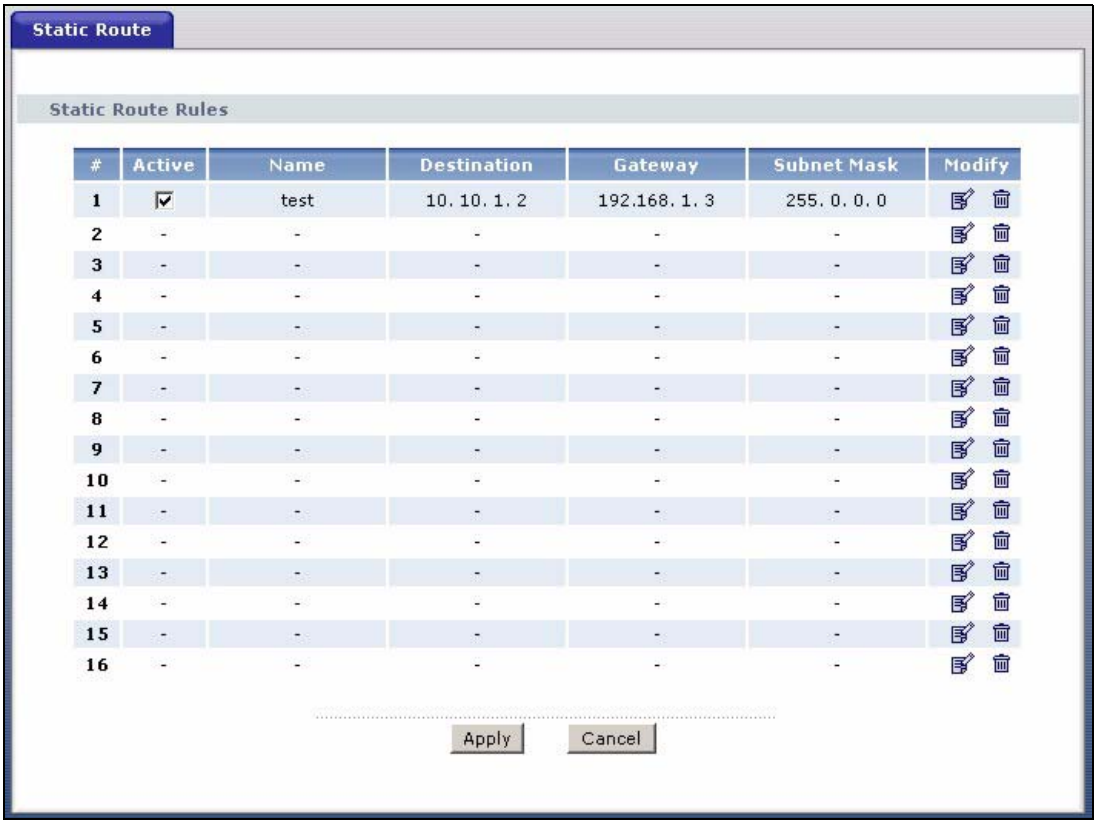
Figure 127 Example of Static Routing Topology



14.2 Configuring Static Route

Click **Advanced** > **Static Route** to open the **Static Route** screen.

Figure 128 Static Route


Static Route
Static Route Rules
Active Name Destination Gateway Subnet Mask Modify
1 test 10.10.1.2 192.168.1.3 255.0.0.0
2 - - - - -
3 - - - - -
4 - - - - -
5 - - - - -
6 - - - - -
7 - - - - -
8 - - - - -
9 - - - - -
10 - - - - -
11 - - - - -
12 - - - - -
13 - - - - -
14 - - - - -
15 - - - - -
16 - - - - -
Apply
Cancel

The following table describes the labels in this screen.

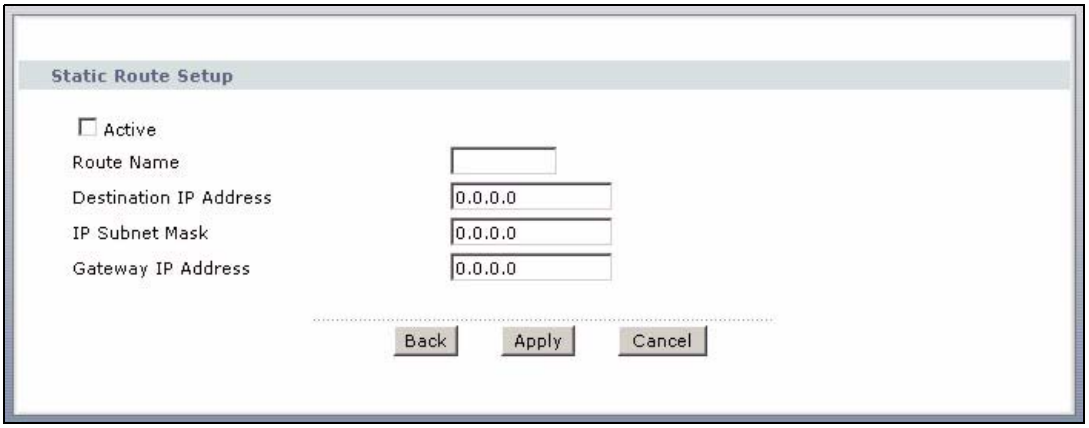
Table 75 Static Route

LABEL	DESCRIPTION
#	This is the number of an individual static route.
Active	Select the check box to activate this static route. Otherwise, clear the check box.
Name	This is the name that describes or identifies this route.
Destination	This parameter specifies the IP network address of the final destination. Routing is always based on network number.
Gateway	This is the IP address of the gateway. The gateway is a router or switch on the same network segment as the device's LAN or WAN port. The gateway helps forward packets to their destinations.
Subnet Mask	This is the IP subnet mask.
Modify	Click the Edit icon to go to the screen where you can set up a static route on the ZyXEL Device. Click the Delete icon to remove a static route from the ZyXEL Device. A window displays asking you to confirm that you want to delete the route.

14.2.1 Static Route Edit

Select a static route index number and click **Edit**. The screen shown next appears. Use this screen to configure the required information for a static route.

Figure 129 Static Route Edit



The following table describes the labels in this screen.

Table 76 Static Route Edit

LABEL	DESCRIPTION
Active	This field allows you to activate/deactivate this static route.
Route Name	Enter the name of the IP static route. Leave this field blank to delete this static route.
Destination IP Address	This parameter specifies the IP network address of the final destination. Routing is always based on network number. If you need to specify a route to a single host, use a subnet mask of 255.255.255.255 in the subnet mask field to force the network number to be identical to the host ID.
IP Subnet Mask	Enter the IP subnet mask here.
Gateway IP Address	Enter the IP address of the gateway. The gateway is a router or switch on the same network segment as the device's LAN or WAN port. The gateway helps forward packets to their destinations.
Back	Click **Back** to return to the previous screen without saving.
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.

15

Bandwidth Management

This chapter contains information about configuring bandwidth management, editing rules and viewing the ZyXEL Device's bandwidth management logs.

15.1 Bandwidth Management Overview

ZyXEL's Bandwidth Management allows you to specify bandwidth management rules based on an application and/or subnet. You can allocate specific amounts of bandwidth capacity (bandwidth budgets) to different bandwidth rules.

The ZyXEL Device applies bandwidth management to traffic that it forwards out through an interface. The ZyXEL Device does not control the bandwidth of traffic that comes into an interface.

Bandwidth management applies to all traffic flowing out of the router, regardless of the traffic's source.

Traffic redirect or IP alias may cause LAN-to-LAN traffic to pass through the ZyXEL Device and be managed by bandwidth management.

The sum of the bandwidth allotments that apply to any interface must be less than or equal to the speed allocated to that interface in the **Bandwidth Management > Summary** screen.

15.2 Application-based Bandwidth Management

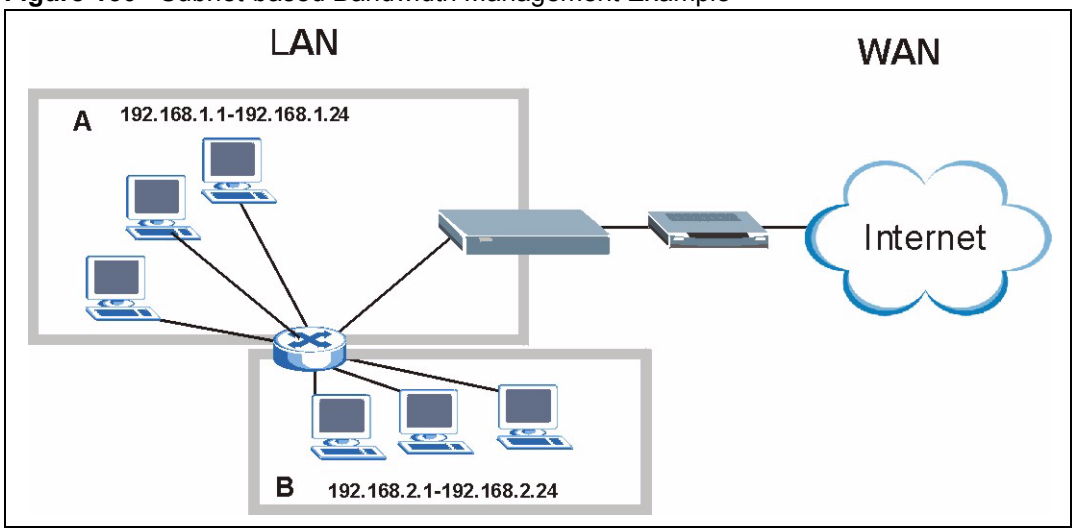
You can create bandwidth classes based on individual applications (like VoIP, Web, FTP, E-mail and Video for example).

15.3 Subnet-based Bandwidth Management

You can create bandwidth classes based on subnets.

The following figure shows LAN subnets. You could configure one bandwidth class for subnet **A** and another for subnet **B**.

Figure 130 Subnet-based Bandwidth Management Example



15.4 Application and Subnet-based Bandwidth Management

You could also create bandwidth classes based on a combination of a subnet and an application. The following example table shows bandwidth allocations for application specific traffic from separate LAN subnets.

Table 77 Application and Subnet-based Bandwidth Management Example

TRAFFIC TYPE	FROM SUBNET A	FROM SUBNET B
VoIP	64 Kbps	64 Kbps
Web	64 Kbps	64 Kbps
FTP	64 Kbps	64 Kbps
E-mail	64 Kbps	64 Kbps
Video	64 Kbps	64 Kbps

15.5 Scheduler

The scheduler divides up an interface's bandwidth among the bandwidth classes. The ZyXEL Device has two types of scheduler: fairness-based and priority-based.

15.5.1 Priority-based Scheduler

With the priority-based scheduler, the ZyXEL Device forwards traffic from bandwidth classes according to the priorities that you assign to the bandwidth classes. The larger a bandwidth class's priority number is, the higher the priority. Assign real-time applications (like those using audio or video) a higher priority number to provide smoother operation.

15.5.2 Fairness-based Scheduler

The ZyXEL Device divides bandwidth equally among bandwidth classes when using the fairness-based scheduler; thus preventing one bandwidth class from using all of the interface's bandwidth.

15.6 Maximize Bandwidth Usage

The maximize bandwidth usage option (see Figure 131 on page 210) allows the ZyXEL Device to divide up any available bandwidth on the interface (including unallocated bandwidth and any allocated bandwidth that a class is not using) among the bandwidth classes that require more bandwidth.

When you enable maximize bandwidth usage, the ZyXEL Device first makes sure that each bandwidth class gets up to its bandwidth allotment. Next, the ZyXEL Device divides up an interface's available bandwidth (bandwidth that is unbudgeted or unused by the classes) depending on how many bandwidth classes require more bandwidth and on their priority levels. When only one class requires more bandwidth, the ZyXEL Device gives extra bandwidth to that class.

When multiple classes require more bandwidth, the ZyXEL Device gives the highest priority classes the available bandwidth first (as much as they require, if there is enough available bandwidth), and then to lower priority classes if there is still bandwidth available. The ZyXEL Device distributes the available bandwidth equally among classes with the same priority level.

15.6.1 Reserving Bandwidth for Non-Bandwidth Class Traffic

Do the following three steps to configure the ZyXEL Device to allow bandwidth for traffic that is not defined in a bandwidth filter.

1. Leave some of the interface's bandwidth unbudgeted.
2. Do not enable the interface's **Maximize Bandwidth Usage** option.
3. Do not enable bandwidth borrowing on the child-classes that have the root class as their parent (see Section 15.9 on page 211).

15.6.2 Maximize Bandwidth Usage Example

Here is an example of a ZyXEL Device that has maximize bandwidth usage enabled on an interface. The following table shows each bandwidth class's bandwidth budget. The classes are set up based on subnets. The interface is set to 10240 kbps. Each subnet is allocated 2048 kbps. The unbudgeted 2048 kbps allows traffic not defined in any of the bandwidth filters to go out when you do not select the maximize bandwidth option.

Table 78 Maximize Bandwidth Usage Example

BANDWIDTH CLASSES AND ALLOTMENTS	
Root Class: 10240 kbps	Administration: 2048 kbps
	Sales: 2048 kbps
	Marketing: 2048 kbps
	Research: 2048 kbps

The ZyXEL Device divides up the unbudgeted 2048 kbps among the classes that require more bandwidth. If the administration department only uses 1024 kbps of the budgeted 2048 kbps, the ZyXEL Device also divides the remaining 1024 kbps among the classes that require more bandwidth. Therefore, the ZyXEL Device divides a total of 3072 kbps of unbudgeted and unused bandwidth among the classes that require more bandwidth.

15.6.2.1 Priority-based Allotment of Unused and Unbudgeted Bandwidth

The following table shows the priorities of the bandwidth classes and the amount of bandwidth that each class gets.

Table 79 Priority-based Allotment of Unused and Unbudgeted Bandwidth Example

BANDWIDTH CLASSES, PRIORITIES AND ALLOTMENTS	
Root Class: 10240 kbps	Administration: Priority 4, 1024 kbps
	Sales: Priority 6, 3584 kbps
	Marketing: Priority 6, 3584 kbps
	Research: Priority 5, 2048 kbps

Suppose that all of the classes except for the administration class need more bandwidth.

- Each class gets up to its budgeted bandwidth. The administration class only uses 1024 kbps of its budgeted 2048 kbps.
- The sales and marketing are first to get extra bandwidth because they have the highest priority (6). If they each require 1536 kbps or more of extra bandwidth, the ZyXEL Device divides the total 3072 kbps total of unbudgeted and unused bandwidth equally between the sales and marketing departments (1536 kbps extra to each for a total of 3584 kbps for each) because they both have the highest priority level.
- Research requires more bandwidth but only gets its budgeted 2048 kbps because all of the unbudgeted and unused bandwidth goes to the higher priority sales and marketing classes.

15.6.2.2 Fairness-based Allotment of Unused and Unbudgeted Bandwidth

The following table shows the amount of bandwidth that each class gets.

Table 80 Fairness-based Allotment of Unused and Unbudgeted Bandwidth Example

BANDWIDTH CLASSES AND ALLOTMENTS	
Root Class: 10240 kbps	Administration: 1024 kbps
	Sales: 3072 kbps
	Marketing: 3072 kbps
	Research: 3072 kbps

Suppose that all of the classes except for the administration class need more bandwidth.

- Each class gets up to its budgeted bandwidth. The administration class only uses 1024 kbps of its budgeted 2048 kbps.
- The ZyXEL Device divides the total 3072 kbps total of unbudgeted and unused bandwidth equally among the other classes. 1024 kbps extra goes to each so the other classes each get a total of 3072 kbps.

15.6.3 Bandwidth Management Priorities

The following table describes the priorities that you can apply to traffic that the ZyXEL Device forwards out through an interface.

Table 81 Bandwidth Management Priorities

PRIORITY LEVELS: TRAFFIC WITH A HIGHER PRIORITY GETS THROUGH FASTER WHILE TRAFFIC WITH A LOWER PRIORITY IS DROPPED IF THE NETWORK IS CONGESTED.	
High	Typically used for voice traffic or video that is especially sensitive to jitter (jitter is the variations in delay).
Mid	Typically used for “excellent effort” or better than best effort and would include important business traffic that can tolerate some delay.
Low	This is typically used for non-critical “background” traffic such as bulk transfers that are allowed but that should not affect other applications and users.

15.7 Over Allotment of Bandwidth

You can set the bandwidth management speed for an interface higher than the interface’s actual transmission speed. Higher priority traffic gets to use up to its allocated bandwidth, even if it takes up all of the interface’s available bandwidth. This could stop lower priority traffic from being sent. The following is an example.

Table 82 Over Allotment of Bandwidth Example

BANDWIDTH CLASSES, ALLOTMENTS		PRIORITIES
Actual outgoing bandwidth available on the interface: 1000 kbps		
Root Class: 1500 kbps (same as Speed setting)	VoIP traffic (Service = SIP): 500 Kbps	High
	NetMeeting traffic (Service = H.323): 500 kbps	High
	FTP (Service = FTP): 500 Kbps	Medium

If you use VoIP and NetMeeting at the same time, the device allocates up to 500 Kbps of bandwidth to each of them before it allocates any bandwidth to FTP. As a result, FTP can only use bandwidth when VoIP and NetMeeting do not use all of their allocated bandwidth.

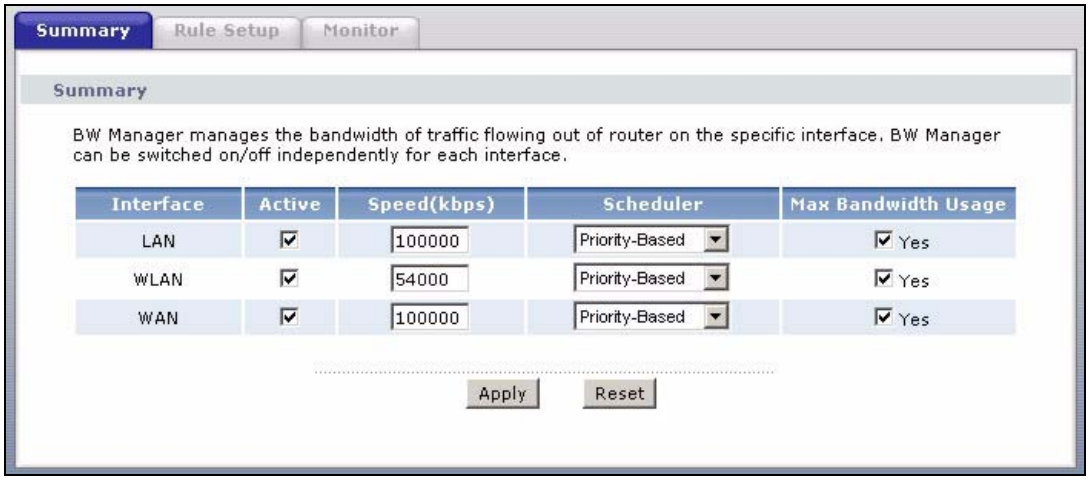
Suppose you try to browse the web too. In this case, VoIP, NetMeeting and FTP all have higher priority, so they get to use the bandwidth first. You can only browse the web when VoIP, NetMeeting, and FTP do not use all 1000 Kbps of available bandwidth.

15.8 Configuring Summary

Click **Advanced > Bandwidth MGMT** to open the screen as shown next.

Enable bandwidth management on an interface and set the maximum allowed bandwidth for that interface.

Figure 131 Bandwidth Management: Summary



The following table describes the labels in this screen.

Table 83 Media Bandwidth Management: Summary

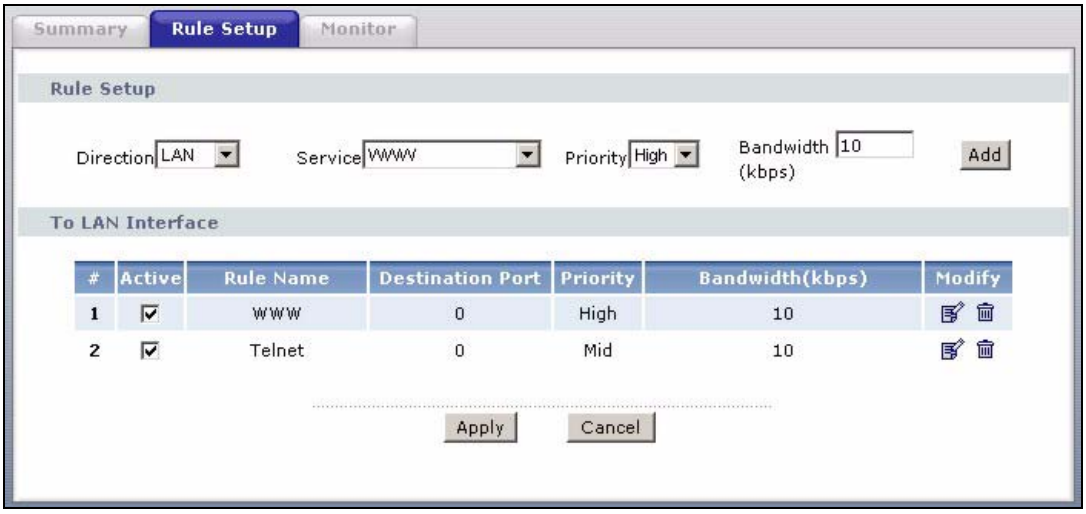
LABEL	DESCRIPTION
Interface	These read-only labels represent the physical interfaces. Select an interface's check box to enable bandwidth management on that interface. Bandwidth management applies to all traffic flowing out of the router through the interface, regardless of the traffic's source. Traffic redirect or IP alias may cause LAN-to-LAN traffic to pass through the ZyXEL Device and be managed by bandwidth management.
Active	Select an interface's check box to enable bandwidth management on that interface.
Speed (kbps)	Enter the amount of bandwidth for this interface that you want to allocate using bandwidth management. The recommendation is to set this speed to match the interface's actual transmission speed. For example, set the WAN interface speed to 1000 kbps if your Internet connection has an upstream transmission speed of 1 Mbps. You can set this number higher than the interface's actual transmission speed. This may stop lower priority traffic from being sent if higher priority traffic uses all of the actual bandwidth. You can also set this number lower than the interface's actual transmission speed. If you do not enable **Max Bandwidth Usage**, this will cause the ZyXEL Device to not use some of the interface's available bandwidth.
Scheduler	Select either **Priority-Based** or **Fairness-Based** from the drop-down menu to control the traffic flow. Select **Priority-Based** to give preference to bandwidth classes with higher priorities. Select **Fairness-Based** to treat all bandwidth classes equally.
Max Bandwidth Usage	Select this check box to have the ZyXEL Device divide up all of the interface's unallocated and/or unused bandwidth among the bandwidth classes that require bandwidth. Do not select this if you want to reserve bandwidth for traffic that does not match a bandwidth class or you want to limit the speed of this interface (see the **Speed** field description).
Apply	Click **Apply** to save your settings to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.

15.9 Bandwidth Management Rule Setup

You must use the **Bandwidth Management Summary** screen to enable bandwidth management on an interface before you can configure rules for that interface.

Click **Advanced > Bandwidth MGMT > Rule Setup** to open the following screen.

Figure 132 Bandwidth Management: Rule Setup



The following table describes the labels in this screen.

Table 84 Bandwidth Management: Rule Setup

LABEL	DESCRIPTION
Rule Setup	
Direction	Select the direction of traffic to which you want to apply bandwidth management.
Service	Select a service for your rule or you can select **User Defined** to go to the screen where you can define your own.
Priority	Select a priority from the drop down list box. Choose **High**, **Mid** or **Low**.
Bandwidth (kbps)	Specify the maximum bandwidth allowed for the rule in kbps. The recommendation is a setting between 20 kbps and 20000 kbps for an individual rule.
Add	Click this button to add a rule to the following table.
To X Interface	
#	This is the number of an individual bandwidth management rule.
Active	This displays whether the rule is enabled. Select this check box to have the ZyXEL Device apply this bandwidth management rule. Enable a bandwidth management rule to give traffic that matches the rule priority over traffic that does not match the rule. Enabling a bandwidth management rule also allows you to control the maximum amounts of bandwidth that can be used by traffic that matches the rule.
Rule Name	This is the name of the rule.
Destination Port	This is the port number of the destination. 0 means any destination port.
Priority	This is the priority of this rule.
Bandwidth (kbps)	This is the maximum bandwidth allowed for the rule in kbps.

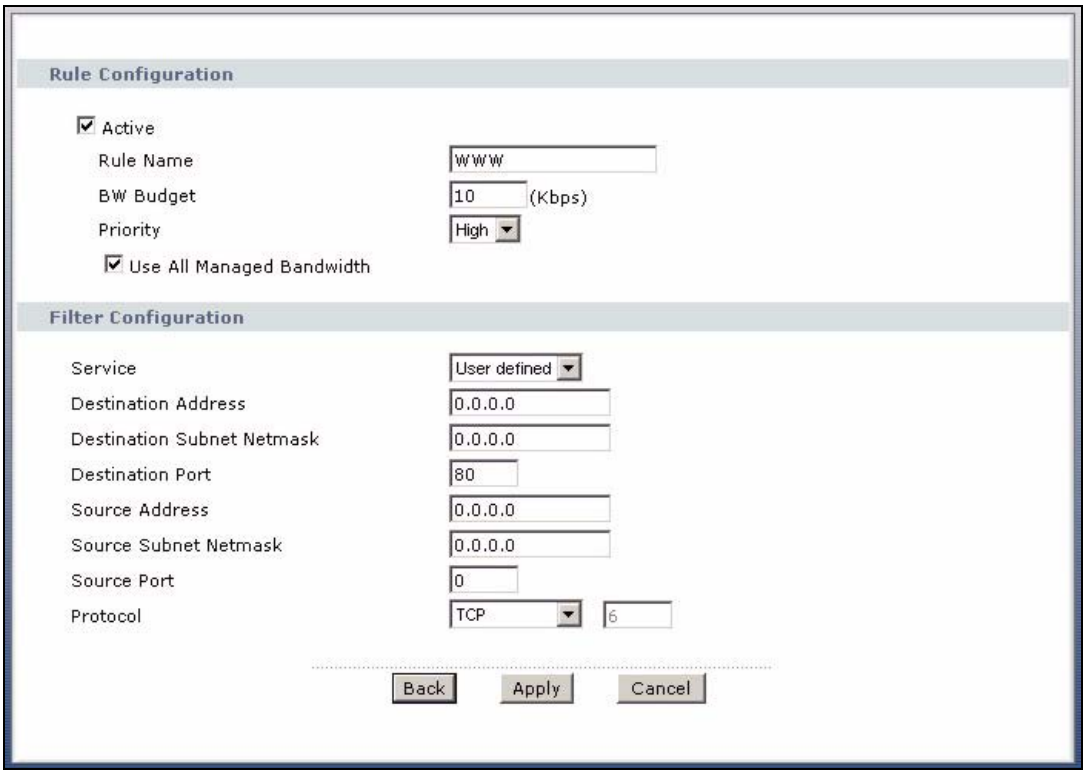
Table 84 Bandwidth Management: Rule Setup (continued)

LABEL	DESCRIPTION
Modify	Click the Edit icon to go to the screen where you can edit the rule. Click the Remove icon to delete an existing rule.
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.

15.9.1 Rule Configuration

Click the Edit icon or select **User Defined** from the **Service** drop-down list in the **Rule Setup** screen to configure a bandwidth management rule. Use bandwidth rules to allocate specific amounts of bandwidth capacity (bandwidth budgets) to specific applications and/or subnets.

Figure 133 Bandwidth Management Rule Configuration



The following table describes the labels in this screen.

Table 85 Bandwidth Management Rule Configuration

LABEL	DESCRIPTION
Rule Configuration	
Active	Select this check box to have the ZyXEL Device apply this bandwidth management rule. Enable a bandwidth management rule to give traffic that matches the rule priority over traffic that does not match the rule. Enabling a bandwidth management rule also allows you to control the maximum amounts of bandwidth that can be used by traffic that matches the rule.
Rule Name	Use the auto-generated name or enter a descriptive name of up to 20 alphanumeric characters, including spaces.

Table 85 Bandwidth Management Rule Configuration (continued)

LABEL	DESCRIPTION
BW Budget	Specify the maximum bandwidth allowed for the rule in kbps. The recommendation is a setting between 20 kbps and 20000 kbps for an individual rule.
Priority	Select a priority from the drop down list box. Choose **High**, **Mid** or **Low**.
Use All Managed Bandwidth	Select this option to allow a rule to borrow unused bandwidth on the interface. Bandwidth borrowing is governed by the priority of the rules. That is, a rule with the highest priority is the first to borrow bandwidth. Do not select this if you want to leave bandwidth available for other traffic types or if you want to restrict the amount of bandwidth that can be used for the traffic that matches this rule.
Filter Configuration	
Service	This field simplifies bandwidth class configuration by allowing you to select a predefined application. When you select a predefined application, you do not configure the rest of the bandwidth filter fields (other than enabling or disabling the filter). SIP (Session Initiation Protocol) is a signaling protocol used in Internet telephony, instant messaging and other VoIP (Voice over IP) applications. Select **SIP** from the drop-down list box to configure this bandwidth filter for traffic that uses SIP. File Transfer Protocol (FTP) is an Internet file transfer service that operates on the Internet and over TCP/IP networks. A system running the FTP server accepts commands from a system running an FTP client. The service allows users to send commands to the server for uploading and downloading files. Select **FTP** from the drop-down list box to configure this bandwidth filter for FTP traffic. H.323 is a standard teleconferencing protocol suite that provides audio, data and video conferencing. It allows for real-time point-to-point and multipoint communication between client computers over a packet-based network that does not provide a guaranteed quality of service. Select **H.323** from the drop-down list box to configure this bandwidth filter for traffic that uses H.323. Select **User defined** from the drop-down list box if you do not want to use a predefined application for the bandwidth class. When you select **User defined**, you need to configure at least one of the following fields (other than the **Subnet Mask** fields which you only enter if you also enter a corresponding destination or source IP address).
Destination Address	Enter the destination IP address in dotted decimal notation.
Destination Subnet Netmask	Enter the destination subnet mask. This field is N/A if you do not specify a **Destination Address**. Refer to the appendices for more information on IP subnetting.
Destination Port	Enter the port number of the destination. See *Table 86 on page 214* for some common services and port numbers. A blank destination IP address means any destination IP address.
Source Address	Enter the source IP address in dotted decimal notation. A blank source IP address means any source IP address.
Source Subnet Netmask	Enter the destination subnet mask. This field is N/A if you do not specify a **Source Address**. Refer to the appendices for more information on IP subnetting. A blank source port means any source port number.
Source Port	Enter the port number of the source. See Table 86 on page 214 for some common services and port numbers.
Protocol	Select the protocol (**TCP** or **UDP**) or select **User defined** and enter the protocol (service type) number. 0 means any protocol number.
Back	Click **Back** to go to the previous screen.

Table 85 Bandwidth Management Rule Configuration (continued)

LABEL	DESCRIPTION
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.

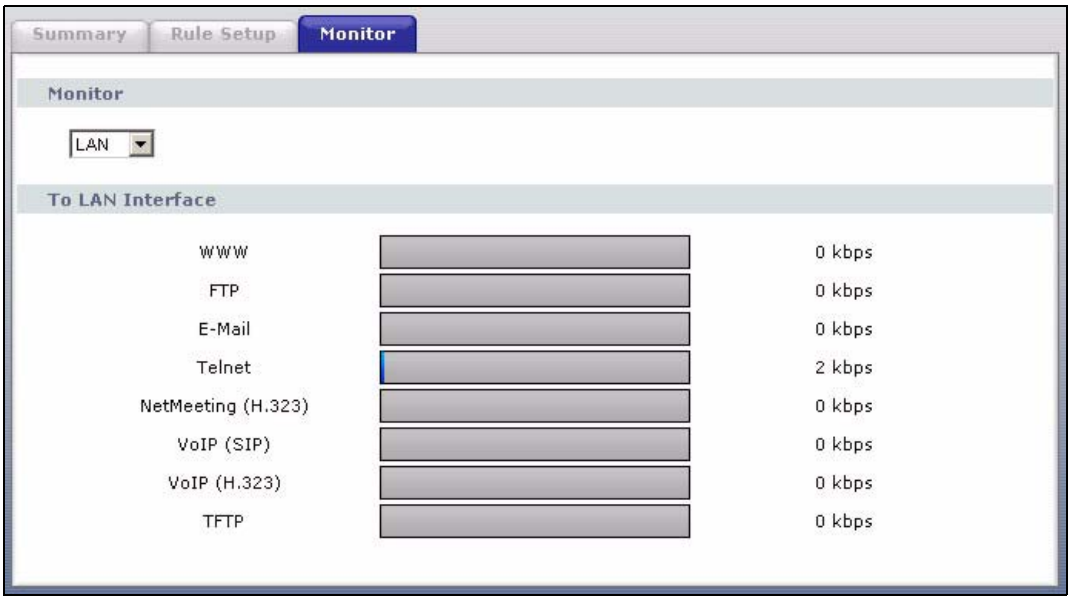
Table 86 Services and Port Numbers

SERVICES	PORT NUMBER
ECHO	7
FTP (File Transfer Protocol)	21
SMTP (Simple Mail Transfer Protocol)	25
DNS (Domain Name System)	53
Finger	79
HTTP (Hyper Text Transfer protocol or WWW, Web)	80
POP3 (Post Office Protocol)	110
NNTP (Network News Transport Protocol)	119
SNMP (Simple Network Management Protocol)	161
SNMP trap	162
PPTP (Point-to-Point Tunneling Protocol)	1723

15.10 Bandwidth Monitor

To view the ZyXEL Device's bandwidth usage and allotments, click **Advanced > Bandwidth MGMT > Monitor**. The screen appears as shown. Select an interface from the drop-down list box to view the bandwidth usage of its bandwidth rules. The gray section of the bar represents the percentage of unused bandwidth and the blue color represents the percentage of bandwidth in use.

Figure 134 Bandwidth Management: Monitor



16

Dynamic DNS Setup

This chapter discusses how to configure your ZyXEL Device to use Dynamic DNS.

16.1 Dynamic DNS Overview

Dynamic DNS allows you to update your current dynamic IP address with one or many dynamic DNS services so that anyone can contact you (in NetMeeting, CU-SeeMe, etc.). You can also access your FTP server or Web site on your own computer using a domain name (for instance myhost.dhs.org, where myhost is a name of your choice) that will never change instead of using an IP address that changes each time you reconnect. Your friends or relatives will always be able to call you even if they don't know your IP address.

First of all, you need to have registered a dynamic DNS account with www.dyndns.org. This is for people with a dynamic IP from their ISP or DHCP server that would still like to have a domain name. The Dynamic DNS service provider will give you a password or key.

16.1.1 DYNDNS Wildcard

Enabling the wildcard feature for your host causes *.yourhost.dyndns.org to be aliased to the same IP address as yourhost.dyndns.org. This feature is useful if you want to be able to use, for example, www.yourhost.dyndns.org and still reach your hostname.

If you have a private WAN IP address, then you cannot use Dynamic DNS.

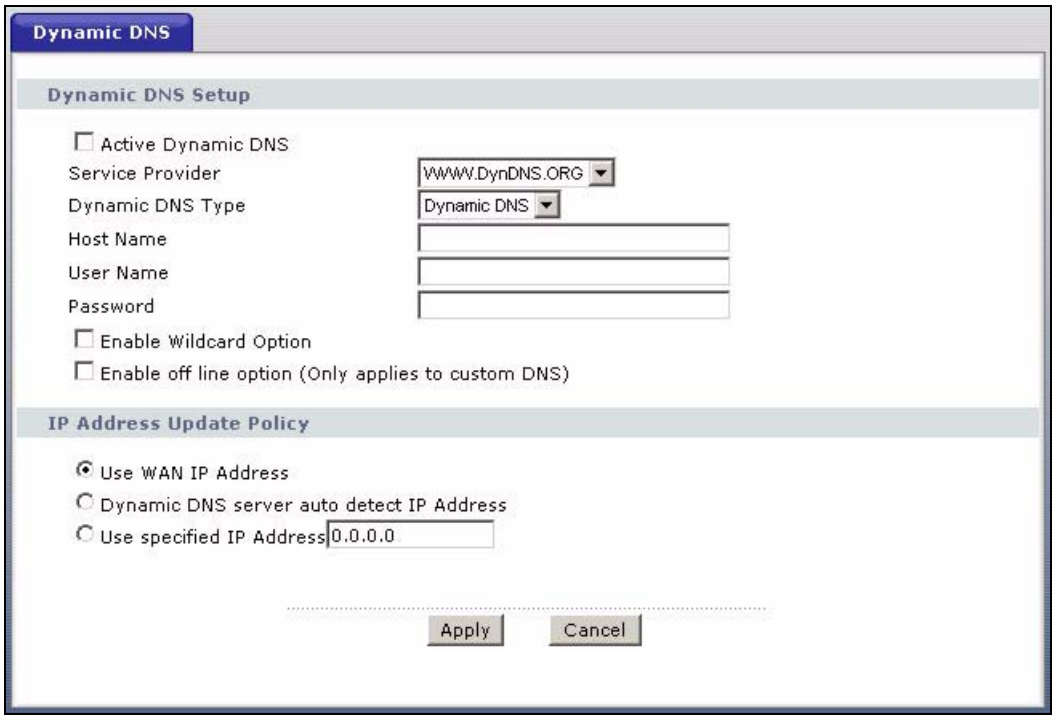
See Section 16.2 on page 217 for configuration instruction.

16.2 Configuring Dynamic DNS

To change your ZyXEL Device's DDNS, click **Advanced > Dynamic DNS**. The screen appears as shown.

See Section 16.1 on page 217 for more information.

Figure 135 Dynamic DNS



The following table describes the fields in this screen.

Table 87 Dynamic DNS

LABEL	DESCRIPTION
Dynamic DNS Setup	
Active Dynamic DNS	Select this check box to use dynamic DNS.
Service Provider	This is the name of your Dynamic DNS service provider.
Dynamic DNS Type	Select the type of service that you are registered for from your Dynamic DNS service provider.
Host Name	Type the domain name assigned to your ZyXEL Device by your Dynamic DNS provider. You can specify up to two host names in the field separated by a comma (",").
User Name	Type your user name.
Password	Type the password assigned to you.
Enable Wildcard Option	Select the check box to enable DynDNS Wildcard.
Enable off line option	This option is available when **Custom DNS** is selected in the **DDNS Type** field. Check with your Dynamic DNS service provider to have traffic redirected to a URL (that you can specify) while you are off line.
IP Address Update Policy	
Use WAN IP Address	Select this option to update the IP address of the host name(s) to the WAN IP address.

Table 87 Dynamic DNS (continued)

LABEL	DESCRIPTION
Dynamic DNS server auto detect IP Address	Select this option only when there are one or more NAT routers between the ZyXEL Device and the DDNS server. This feature has the DDNS server automatically detect and use the IP address of the NAT router that has a public IP address. Note: The DDNS server may not be able to detect the proper IP address if there is an HTTP proxy server between the ZyXEL Device and the DDNS server.
Use specified IP Address	Type the IP address of the host name(s). Use this if you have a static IP address.
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.

17

Remote Management Configuration

This chapter provides information on configuring remote management.

17.1 Remote Management Overview

Remote management allows you to determine which services/protocols can access which ZyXEL Device interface (if any) from which computers.

When you configure remote management to allow management from the WAN, you still need to configure a firewall rule to allow access.

You may manage your ZyXEL Device from a remote location via:

- Internet (WAN only)
- ALL (LAN and WAN)
- LAN only,
- Neither (Disable).

When you choose **WAN** only or **LAN & WAN**, you still need to configure a firewall rule to allow access.

To disable remote management of a service, select **Disable** in the corresponding **Access Status** field.

You may only have one remote management session running at a time. The ZyXEL Device automatically disconnects a remote management session of lower priority when another remote management session of higher priority starts. The priorities for the different types of remote management sessions are as follows.

1. Telnet
2. HTTP

17.1.1 Remote Management Limitations

Remote management over LAN or WAN will not work when:

- You have disabled that service in one of the remote management screens.
- The IP address in the **Secured Client IP** field does not match the client IP address. If it does not match, the ZyXEL Device will disconnect the session immediately.
- There is already another remote management session with an equal or higher priority running. You may only have one remote management session running at one time.
- There is a firewall rule that blocks it.

17.1.2 Remote Management and NAT

When NAT is enabled:

- Use the ZyXEL Device's WAN IP address when configuring from the WAN.
- Use the ZyXEL Device's LAN IP address when configuring from the LAN.

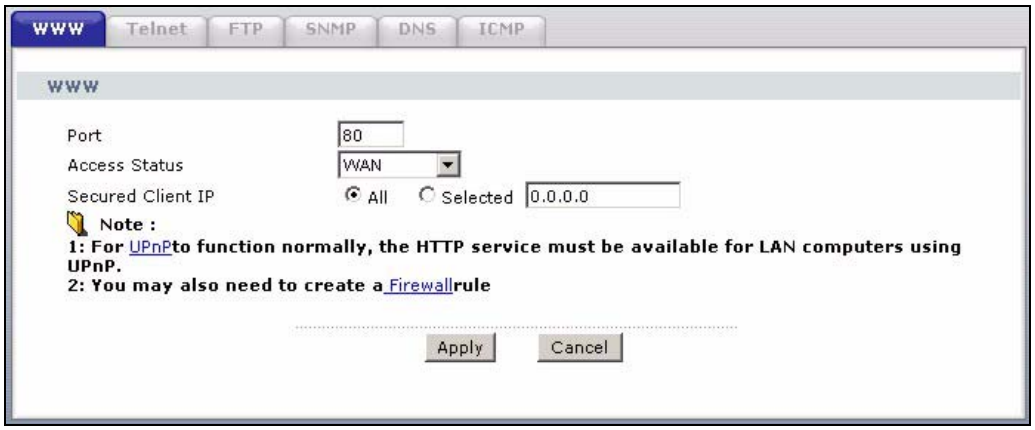
17.1.3 System Timeout

There is a default system management idle timeout of five minutes (three hundred seconds). The ZyXEL Device automatically logs you out if the management session remains idle for longer than this timeout period. The management session does not time out when a statistics screen is polling.

17.2 WWW

To change your ZyXEL Device's World Wide Web settings, click **Advanced > Remote MGMT** to display the **WWW** screen.

Figure 136 Remote Management: WWW



The following table describes the labels in this screen.

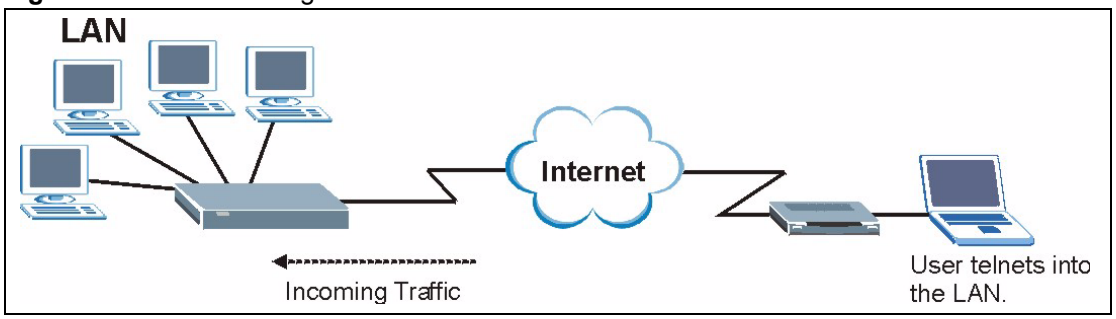
Table 88 Remote Management: WWW

LABEL	DESCRIPTION
Port	You may change the server port number for a service if needed, however you must use the same port number in order to use that service for remote management.
Access Status	Select the interface(s) through which a computer may access the ZyXEL Device using this service.
Secured Client IP	A secured client is a “trusted” computer that is allowed to communicate with the ZyXEL Device using this service. Select **All** to allow any computer to access the ZyXEL Device using this service. Choose **Selected** to just allow the computer with the IP address that you specify to access the ZyXEL Device using this service.
Apply	Click **Apply** to save your settings to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.

17.3 Telnet

You can configure your ZyXEL Device for remote Telnet access as shown next. The administrator uses Telnet from a computer on a remote network to access the ZyXEL Device.

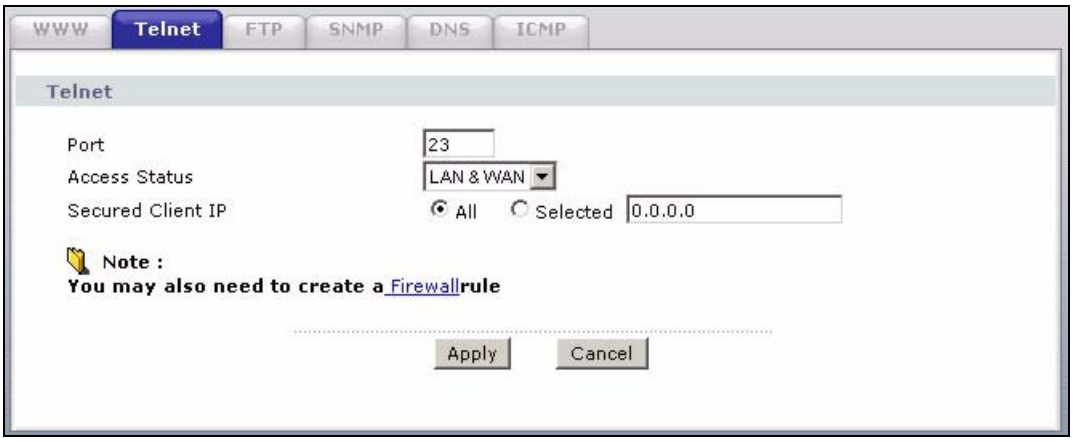
Figure 137 Telnet Configuration on a TCP/IP Network



17.4 Configuring Telnet

Click **Advanced > Remote MGMT** > **Telnet** tab to display the screen as shown.

Figure 138 Remote Management: Telnet



The following table describes the labels in this screen.

Table 89 Remote Management: Telnet

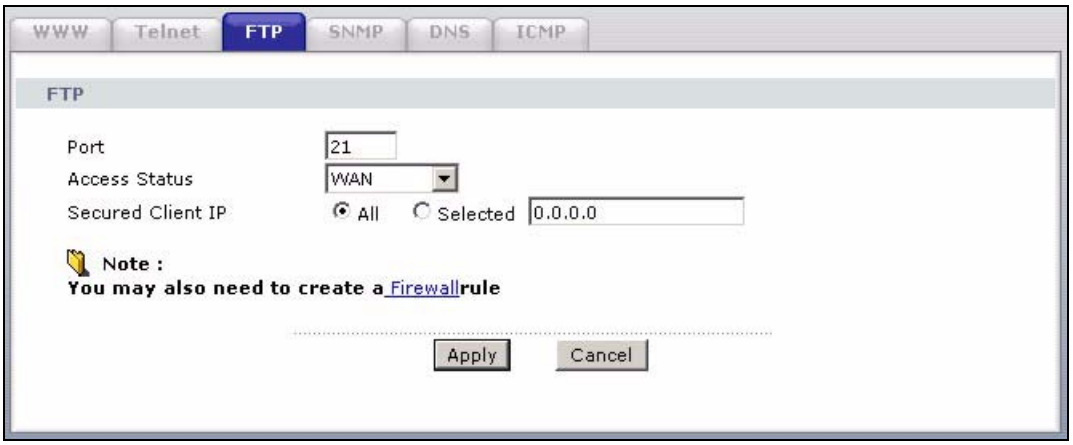
LABEL	DESCRIPTION
Port	You may change the server port number for a service if needed, however you must use the same port number in order to use that service for remote management.
Access Status	Select the interface(s) through which a computer may access the ZyXEL Device using this service.
Secured Client IP	A secured client is a “trusted” computer that is allowed to communicate with the ZyXEL Device using this service. Select **All** to allow any computer to access the ZyXEL Device using this service. Choose **Selected** to just allow the computer with the IP address that you specify to access the ZyXEL Device using this service.
Apply	Click **Apply** to save your customized settings and exit this screen.
Cancel	Click **Cancel** to begin configuring this screen afresh.

17.5 Configuring FTP

You can upload and download the ZyXEL Device’s firmware and configuration files using FTP, please see the chapter on firmware and configuration file maintenance for details. To use this feature, your computer must have an FTP client.

To change your ZyXEL Device’s FTP settings, click **Advanced > Remote MGMT** > **FTP** tab. The screen appears as shown.

Figure 139 Remote Management: FTP



The following table describes the labels in this screen.

Table 90 Remote Management: FTP

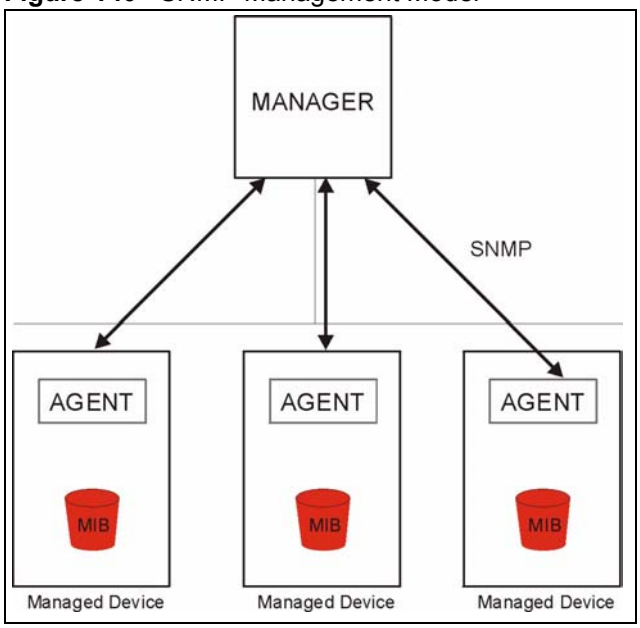
LABEL	DESCRIPTION
Port	You may change the server port number for a service if needed, however you must use the same port number in order to use that service for remote management.
Access Status	Select the interface(s) through which a computer may access the ZyXEL Device using this service.
Secured Client IP	A secured client is a “trusted” computer that is allowed to communicate with the ZyXEL Device using this service. Select **All** to allow any computer to access the ZyXEL Device using this service. Choose **Selected** to just allow the computer with the IP address that you specify to access the ZyXEL Device using this service.
Apply	Click **Apply** to save your customized settings and exit this screen.
Cancel	Click **Cancel** to begin configuring this screen afresh.

17.6 SNMP

Simple Network Management Protocol (SNMP) is a protocol used for exchanging management information between network devices. SNMP is a member of the TCP/IP protocol suite. Your ZyXEL Device supports SNMP agent functionality, which allows a manager station to manage and monitor the ZyXEL Device through the network. The ZyXEL Device supports SNMP version one (SNMPv1) and version two (SNMPv2). The next figure illustrates an SNMP management operation.

SNMP is only available if TCP/IP is configured.

Figure 140 SNMP Management Model



An SNMP managed network consists of two main types of component: agents and a manager.

An agent is a management software module that resides in a managed device (the ZyXEL Device). An agent translates the local management information from the managed device into a form compatible with SNMP. The manager is the console through which network administrators perform network management functions. It executes applications that control and monitor managed devices.

The managed devices contain object variables/managed objects that define each piece of information to be collected about a device. Examples of variables include such as number of packets received, node port status etc. A Management Information Base (MIB) is a collection of managed objects. SNMP allows a manager and agents to communicate for the purpose of accessing these objects.

SNMP itself is a simple request/response protocol based on the manager/agent model. The manager issues a request and the agent returns responses using the following protocol operations:

- Get - Allows the manager to retrieve an object variable from the agent.
- GetNext - Allows the manager to retrieve the next object variable from a table or list within an agent. In SNMPv1, when a manager wants to retrieve all elements of a table from an agent, it initiates a Get operation, followed by a series of GetNext operations.
- Set - Allows the manager to set values for object variables within an agent.
- Trap - Used by the agent to inform the manager of some events.

17.6.1 Supported MIBs

The ZyXEL Device supports MIB II that is defined in RFC-1213 and RFC-1215. The focus of the MIBs is to let administrators collect statistical data and monitor status and performance.

17.6.2 SNMP Traps

The ZyXEL Device will send traps to the SNMP manager when any one of the following events occurs:

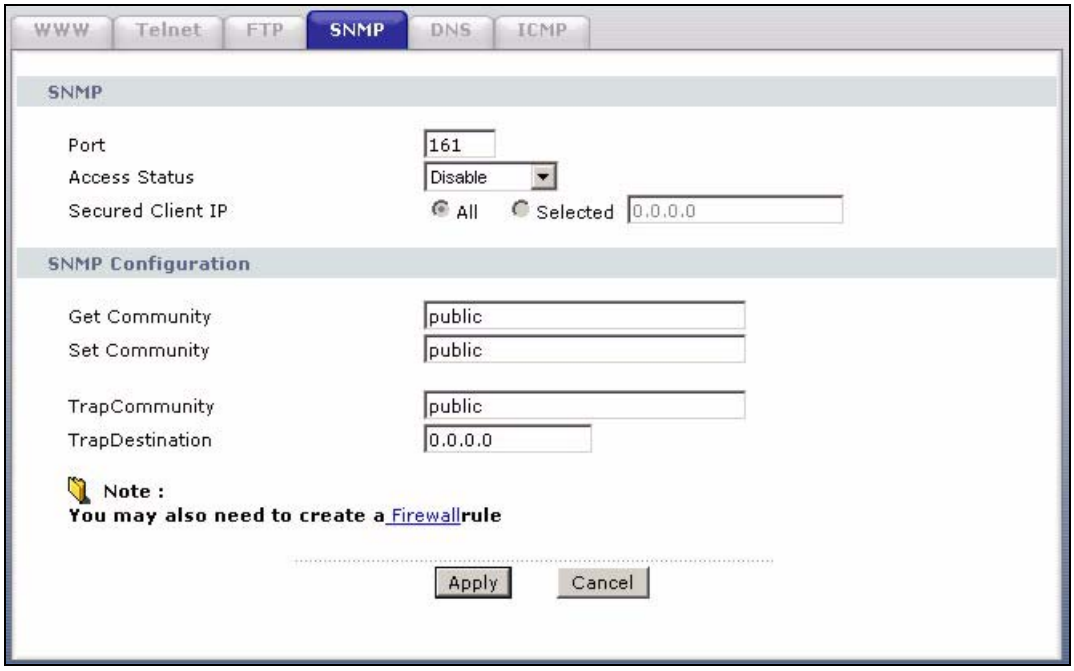
Table 91 SNMP Traps

TRAP #	TRAP NAME	DESCRIPTION
0	coldStart (defined in *RFC-1215*)	A trap is sent after booting (power on).
1	warmStart (defined in *RFC-1215*)	A trap is sent after booting (software reboot).
6	whyReboot (defined in ZYXEL-MIB)	A trap is sent with the reason of restart before rebooting when the system is going to restart (warm start).
6a	For intentional reboot:	A trap is sent with the message "System reboot by user!" if reboot is done intentionally, (for example, download new files, CI command "sys reboot", etc.).
6b	For fatal error:	A trap is sent with the message of the fatal code if the system reboots because of fatal errors.

17.6.3 Configuring SNMP

To change your ZyXEL Device's SNMP settings, click **Advanced > Remote MGMT** > **SNMP**. The screen appears as shown.

Figure 141 Remote Management: SNMP



The following table describes the labels in this screen.

Table 92 Remote Management: SNMP

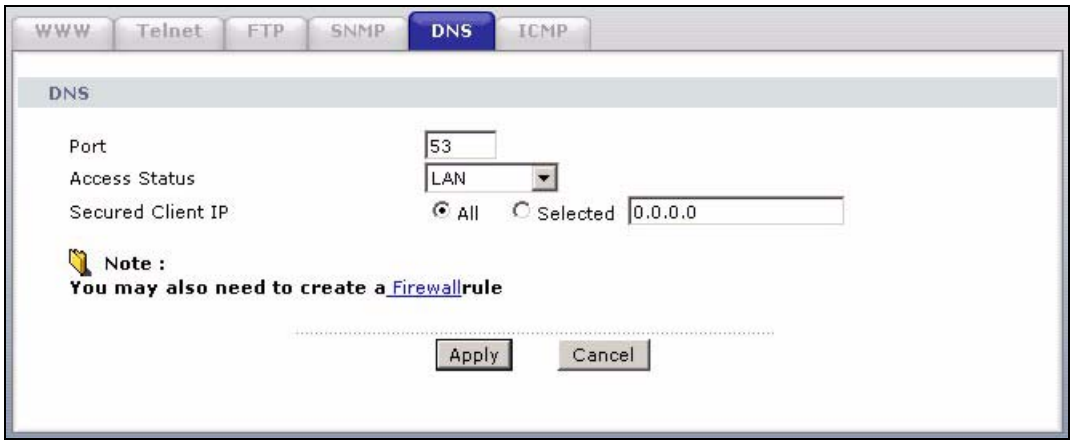
LABEL	DESCRIPTION
SNMP	
Port	You may change the server port number for a service if needed, however you must use the same port number in order to use that service for remote management.
Access Status	Select the interface(s) through which a computer may access the ZyXEL Device using this service.
Secured Client IP	A secured client is a “trusted” computer that is allowed to communicate with the ZyXEL Device using this service. Select **All** to allow any computer to access the ZyXEL Device using this service. Choose **Selected** to just allow the computer with the IP address that you specify to access the ZyXEL Device using this service.
SNMP Configuration	
Get Community	Enter the **Get Community**, which is the password for the incoming Get and GetNext requests from the management station. The default is public and allows all requests.
Set Community	Enter the **Set community**, which is the password for incoming Set requests from the management station. The default is public and allows all requests.
Trap Community	Type the trap community, which is the password sent with each trap to the SNMP manager. The default is public and allows all requests.
Trap Destination	Type the IP address of the station to send your SNMP traps to.
Apply	Click **Apply** to save your customized settings and exit this screen.
Cancel	Click **Cancel** to begin configuring this screen afresh.

17.7 Configuring DNS

Use DNS (Domain Name System) to map a domain name to its corresponding IP address and vice versa. Refer to the chapter on LAN for background information.

To change your ZyXEL Device’s DNS settings, click **Advanced > Remote MGMT** > **DNS**. The screen appears as shown. Use this screen to set from which IP address the ZyXEL Device will accept DNS queries and on which interface it can send them your ZyXEL Device’s DNS settings.

Figure 142 Remote Management: DNS



The following table describes the labels in this screen.

Table 93 Remote Management: DNS

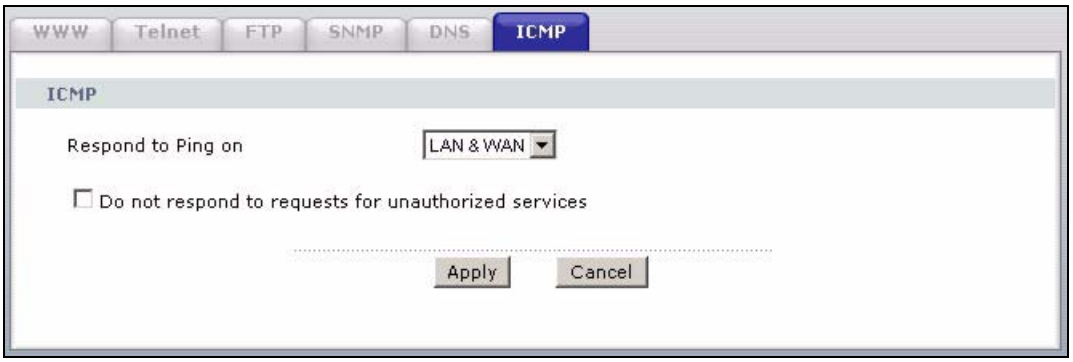
LABEL	DESCRIPTION
Port	The DNS service port number is 53.
Access Status	Select the interface(s) through which a computer may send DNS queries to the ZyXEL Device.
Secured Client IP	A secured client is a “trusted” computer that is allowed to send DNS queries to the ZyXEL Device. Select **All** to allow any computer to send DNS queries to the ZyXEL Device. Choose **Selected** to just allow the computer with the IP address that you specify to send DNS queries to the ZyXEL Device.
Apply	Click **Apply** to save your customized settings and exit this screen.
Cancel	Click **Cancel** to begin configuring this screen afresh.

17.8 Configuring ICMP

To change your ZyXEL Device’s security settings, click **Advanced > Remote MGMT** > **ICMP**. The screen appears as shown.

If an outside user attempts to probe an unsupported port on your ZyXEL Device, an ICMP response packet is automatically returned. This allows the outside user to know the ZyXEL Device exists. Your ZyXEL Device supports anti-probing, which prevents the ICMP response packet from being sent. This keeps outsiders from discovering your ZyXEL Device when unsupported ports are probed.

Figure 143 Remote Management: ICMP



The following table describes the labels in this screen.

Table 94 Remote Management: ICMP

LABEL	DESCRIPTION
ICMP	Internet Control Message Protocol is a message control and error-reporting protocol between a host server and a gateway to the Internet. ICMP uses Internet Protocol (IP) datagrams, but the messages are processed by the TCP/IP software and directly apparent to the application user.
Respond to Ping on	The ZyXEL Device will not respond to any incoming Ping requests when **Disable** is selected. Select **LAN** to reply to incoming LAN Ping requests. Select **WAN** to reply to incoming WAN Ping requests. Otherwise select **LAN & WAN** to reply to both incoming LAN and WAN Ping requests.
Do not respond to requests for unauthorized services	Select this option to prevent hackers from finding the ZyXEL Device by probing for unused ports. If you select this option, the ZyXEL Device will not respond to port request(s) for unused ports, thus leaving the unused ports and the ZyXEL Device unseen. By default this option is not selected and the ZyXEL Device will reply with an ICMP Port Unreachable packet for a port probe on its unused UDP ports, and a TCP Reset packet for a port probe on its unused TCP ports. Note that the probing packets must first traverse the ZyXEL Device's firewall mechanism before reaching this anti-probing mechanism. Therefore if the firewall mechanism blocks a probing packet, the ZyXEL Device reacts based on the corresponding firewall policy to send a TCP reset packet for a blocked TCP packet or an ICMP port-unreachable packet for a blocked UDP packets or just drop the packets without sending a response packet.
Apply	Click **Apply** to save your customized settings and exit this screen.
Cancel	Click **Cancel** to begin configuring this screen afresh.

17.9 TR-069

TR-069 is a DSL Forum standard that defines how CPE (Customer Premise Equipment), for example your ZyXEL Device, can be managed over the WAN by an Auto Configuration Server (ACS) such as ZyXEL's CNM Access. TR-069 is based on sending RPCs (Remote Procedure Call) between an ACS and a client device. RPCs are sent in XML (Extensible Markup Language) format over HTTP or HTTPS.

An administrator can use CNM Access to remotely set up the ZyXEL device, modify settings, perform firmware upgrades as well as monitor and diagnose the ZyXEL device. All you have to do is enable the device to be managed by CNM Access and specify the CNM Access IP address or domain name and username and password.

Follow the procedure below to configure your ZyXEL Device to be managed by CNM Access. See the Command Interpreter appendix for information on the command structure and how to access the CLI (Command Line Interface) on the ZyXEL Device.

In this example **a.b.c.d** is the IP address of CNM Access. You must change this value to reflect your actual management server IP address or domain name. See **Table 95 on page 231** for detailed descriptions of the commands.

Figure 144 Enabling TR-069

```
ras> wan tr069 load
ras> wan tr069 acsUrl a.b.c.d
Auto-Configuration Server URL: http://a.b.c.d
ras> wan tr069 periodicEnable 1
ras> wan tr069 informInterval 2400
TR069 Informinterval 2400
ras> wan tr069 active 1
ras> wan tr069 save
```

The following table gives a description of TR-069 commands.

Table 95 TR-069 Commands

ROOT	COMMAND OR SUBDIRECTORY	COMMAND	DESCRIPTION
wan	tr069		All TR-069 related commands must be preceded by `wan tr069`.
		load	Start configuring TR-069 on your ZyXEL Device.
		active [0:no/ 1:yes]	Enable/disable TR-069 operation.
		acsUrl <URL>	Set the IP address or domain name of CNM Access.
		username [maxlength:15]	Username used to authenticate the device when making a connection to CNM Access. This username is set up on the server and must be provided by the CNM Access administrator.
		password [maxlength:15]	Password used to authenticate the device when making a connection to CNM Access. This password is set up on the server and must be provided by the CNM Access administrator.
		periodicEnable [0:Disable/ 1:Enable]	Whether or not the device must periodically send information to CNM Access. It is recommended to set this value to `1` in order for the ZyXEL Device to send information to CNM Access.
		informInterval [sec]	The duration in seconds of the interval for which the device MUST attempt to connect with CNM Access to send information and check for configuration updates. Enter a value between 30 and 2147483647 seconds.
		save	Save the TR-069 settings to your ZyXEL Device.

18

Universal Plug-and-Play (UPnP)

This chapter introduces the UPnP feature in the web configurator.

18.1 Introducing Universal Plug and Play

Universal Plug and Play (UPnP) is a distributed, open networking standard that uses TCP/IP for simple peer-to-peer network connectivity between devices. A UPnP device can dynamically join a network, obtain an IP address, convey its capabilities and learn about other devices on the network. In turn, a device can leave a network smoothly and automatically when it is no longer in use.

See Section 18.2.1 on page 234 for configuration instructions.

18.1.1 How do I know if I'm using UPnP?

UPnP hardware is identified as an icon in the Network Connections folder (Windows XP). Each UPnP compatible device installed on your network will appear as a separate icon. Selecting the icon of a UPnP device will allow you to access the information and properties of that device.

18.1.2 NAT Traversal

UPnP NAT traversal automates the process of allowing an application to operate through NAT. UPnP network devices can automatically configure network addressing, announce their presence in the network to other UPnP devices and enable exchange of simple product and service descriptions. NAT traversal allows the following:

- Dynamic port mapping
- Learning public IP addresses
- Assigning lease times to mappings

Windows Messenger is an example of an application that supports NAT traversal and UPnP.

See the NAT chapter for more information on NAT.

18.1.3 Cautions with UPnP

The automated nature of NAT traversal applications in establishing their own services and opening firewall ports may present network security issues. Network information and configuration may also be obtained and modified by users in some network environments.

When a UPnP device joins a network, it announces its presence with a multicast message. For security reasons, the ZyXEL Device allows multicast messages only on the LAN.

All UPnP-enabled devices may communicate freely with each other without additional configuration. Disable UPnP if this is not your intention.

You must have IIS (Internet Information Services) enabled on the Windows web server for UPnP to work.

18.2 UPnP and ZyXEL

ZyXEL has achieved UPnP certification from the Universal Plug and Play Forum UPnP™ Implementers Corp. (UIC). ZyXEL's UPnP implementation supports IGD 1.0 (Internet Gateway Device).

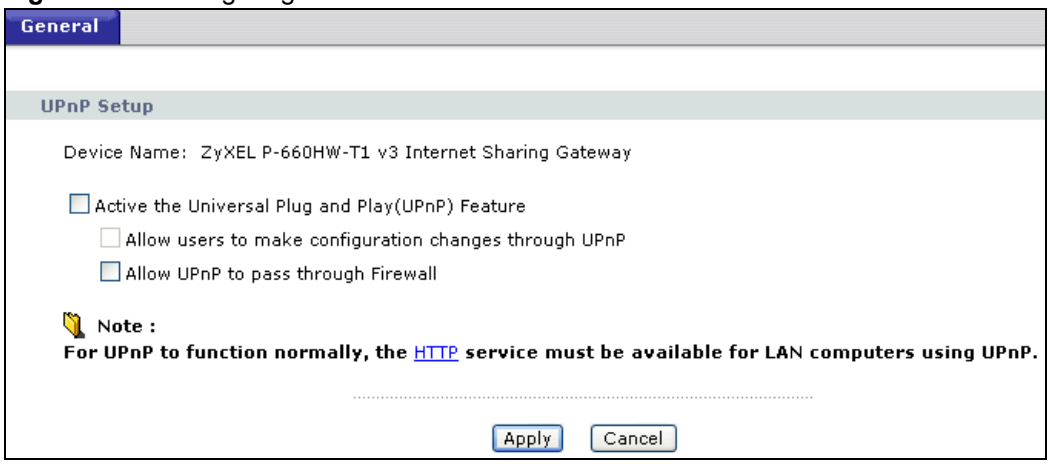
See the following sections for examples of installing and using UPnP.

18.2.1 Configuring UPnP

Click **Advanced > UPnP** to display the screen shown next.

See Section 18.1 on page 233 for more information.

Figure 145 Configuring UPnP


General
UPnP Setup
Device Name: ZyXEL P-660HW-T1 v3 Internet Sharing Gateway
Active the Universal Plug and Play(UPnP) Feature
Allow users to make configuration changes through UPnP
Allow UPnP to pass through Firewall
Note :
For UPnP to function normally, the HTTP service must be available for LAN computers using UPnP.
Apply
Cancel

The following table describes the fields in this screen.

Table 96 Configuring UPnP

LABEL	DESCRIPTION
Active the Universal Plug and Play (UPnP) Feature	Select this check box to activate UPnP. Be aware that anyone could use a UPnP application to open the web configurator's login screen without entering the ZyXEL Device's IP address (although you must still enter the password to access the web configurator).
Allow users to make configuration changes through UPnP	Select this check box to allow UPnP-enabled applications to automatically configure the ZyXEL Device so that they can communicate through the ZyXEL Device, for example by using NAT traversal, UPnP applications automatically reserve a NAT forwarding port in order to communicate with another UPnP enabled device; this eliminates the need to manually configure port forwarding for the UPnP enabled application.

Table 96 Configuring UPnP

LABEL	DESCRIPTION
Allow UPnP to pass through Firewall	Select this check box to allow traffic from UPnP-enabled applications to bypass the firewall. Clear this check box to have the firewall block all UPnP application packets (for example, MSN packets).
Apply	Click **Apply** to save the setting to the ZyXEL Device.
Cancel	Click **Cancel** to return to the previously saved settings.

18.3 Installing UPnP in Windows Example

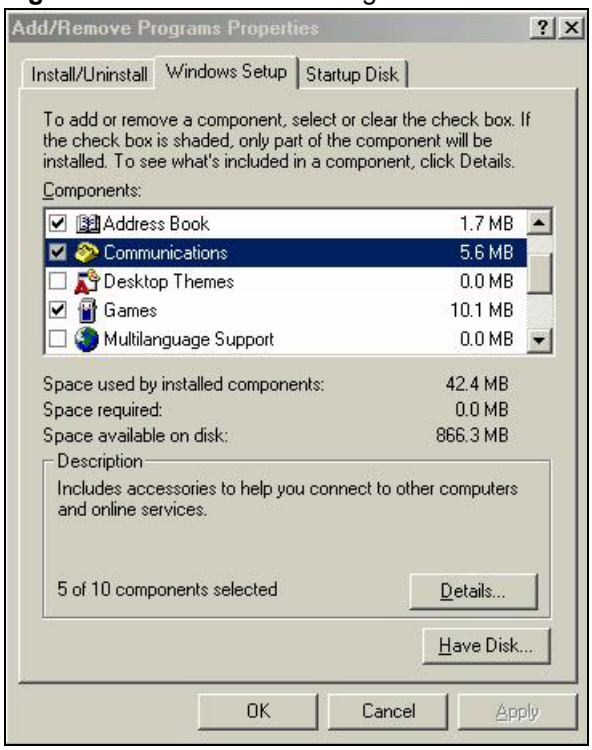
This section shows how to install UPnP in Windows Me and Windows XP.

18.3.1 Installing UPnP in Windows Me

Follow the steps below to install the UPnP in Windows Me.

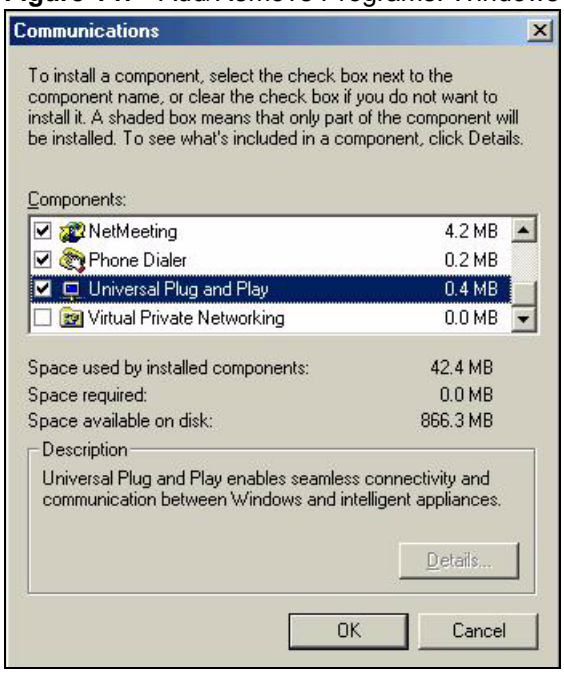
1. Click **Start** and **Control Panel**. Double-click **Add/Remove Programs**.
2. Click on the **Windows Setup** tab and select **Communication** in the **Components** selection box. Click **Details**.

Figure 146 Add/Remove Programs: Windows Setup: Communication


Add/Remove Programs Properties
Install/Uninstall
Windows Setup
Startup Disk
To add or remove a component, select or clear the check box. If the check box is shaded, only part of the component will be installed. To see what's included in a component, click Details.
Components:
Address Book 1.7 MB
Communications 5.6 MB
Desktop Themes 0.0 MB
Games 10.1 MB
Multilanguage Support 0.0 MB
Space used by installed components: 42.4 MB
Space required: 0.0 MB
Space available on disk: 866.3 MB
Description
Includes accessories to help you connect to other computers and online services.
5 of 10 components selected
Details...
Have Disk...
OK
Cancel
Apply

3. In the **Communications** window, select the **Universal Plug and Play** check box in the **Components** selection box.

Figure 147 Add/Remove Programs: Windows Setup: Communication: Components


Communications
To install a component, select the check box next to the component name, or clear the check box if you do not want to install it. A shaded box means that only part of the component will be installed. To see what's included in a component, click Details.
Components:
NetMeeting 4.2 MB
Phone Dialer 0.2 MB
Universal Plug and Play 0.4 MB
Virtual Private Networking 0.0 MB
Space used by installed components: 42.4 MB
Space required: 0.0 MB
Space available on disk: 866.3 MB
Description
Universal Plug and Play enables seamless connectivity and communication between Windows and intelligent appliances.
Details...
OK
Cancel

4 Click **OK** to go back to the **Add/Remove Programs Properties** window and click **Next**.

5 Restart the computer when prompted.

18.3.2 Installing UPnP in Windows XP

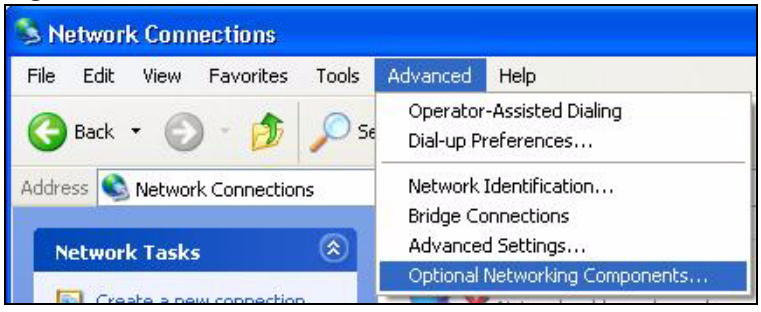
Follow the steps below to install the UPnP in Windows XP.

1 Click **start** and **Control Panel**.

2 Double-click **Network Connections**.

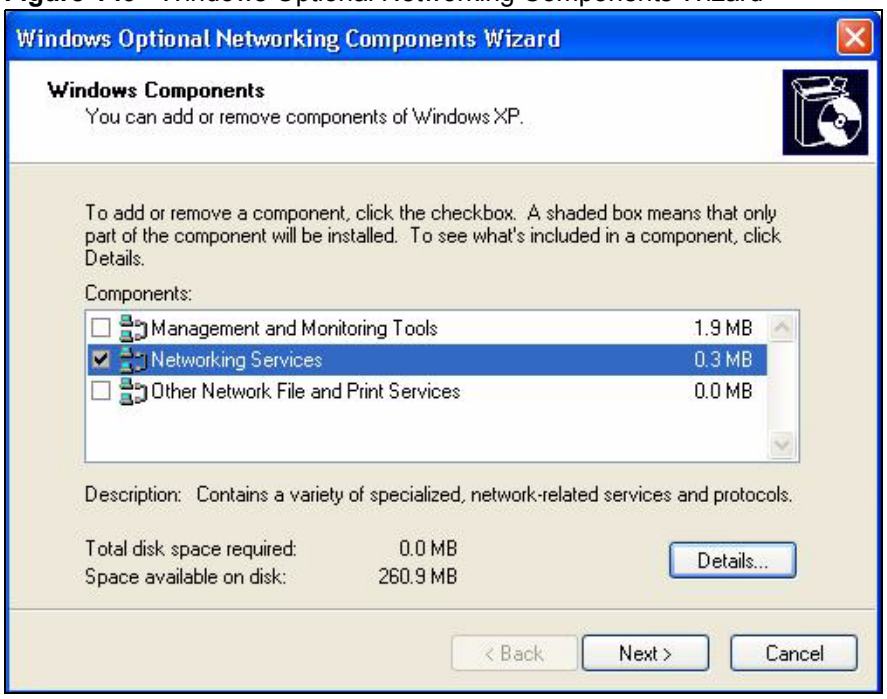
3 In the **Network Connections** window, click **Advanced** in the main menu and select **Optional Networking Components …**.

Figure 148 Network Connections



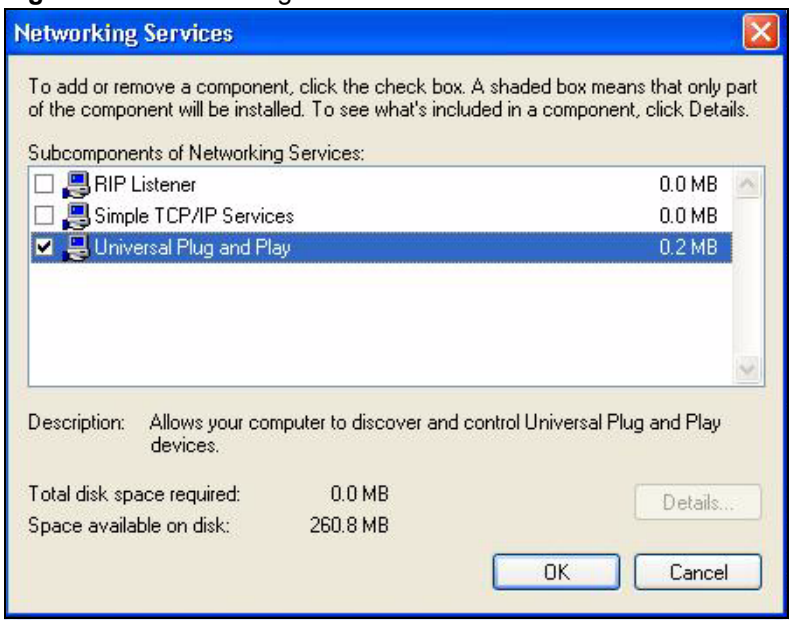
4 The **Windows Optional Networking Components Wizard** window displays. Select **Networking Service** in the **Components** selection box and click **Details**.

Figure 149 Windows Optional Networking Components Wizard


Windows Optional Networking Components Wizard
Windows Components
You can add or remove components of Windows XP.
To add or remove a component, click the checkbox. A shaded box means that only part of the component will be installed. To see what's included in a component, click Details.
Components:
Management and Monitoring Tools 1.9 MB
Networking Services 0.3 MB
Other Network File and Print Services 0.0 MB
Description: Contains a variety of specialized, network-related services and protocols.
Total disk space required: 0.0 MB
Space available on disk: 260.9 MB
Details...
< Back
Next >
Cancel

5 In the **Networking Services** window, select the **Universal Plug and Play** check box.

Figure 150 Networking Services


Networking Services
To add or remove a component, click the check box. A shaded box means that only part of the component will be installed. To see what's included in a component, click Details.
Subcomponents of Networking Services:
RIP Listener 0.0 MB
Simple TCP/IP Services 0.0 MB
Universal Plug and Play 0.2 MB
Description: Allows your computer to discover and control Universal Plug and Play devices.
Total disk space required: 0.0 MB
Space available on disk: 260.8 MB
Details...
OK
Cancel

6 Click **OK** to go back to the **Windows Optional Networking Component Wizard** window and click **Next**.

18.4 Using UPnP in Windows XP Example

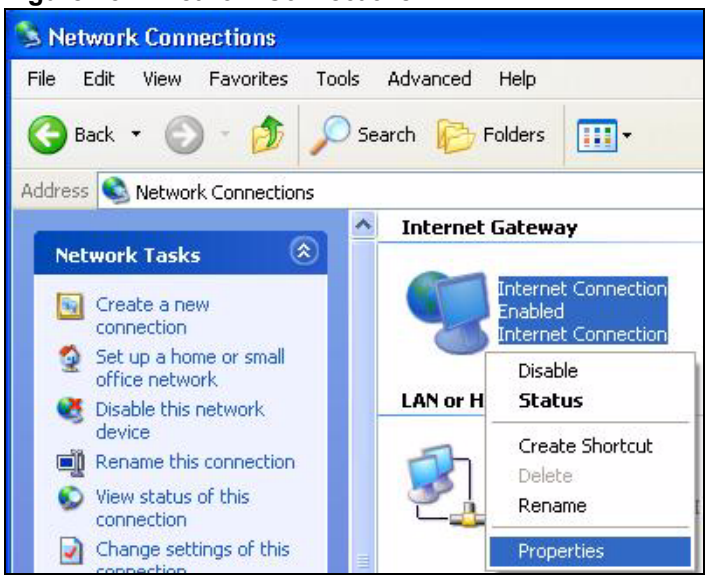
This section shows you how to use the UPnP feature in Windows XP. You must already have UPnP installed in Windows XP and UPnP activated on the ZyXEL Device.

Make sure the computer is connected to a LAN port of the ZyXEL Device. Turn on your computer and the ZyXEL Device.

18.4.1 Auto-discover Your UPnP-enabled Network Device

1. Click **start** and **Control Panel**. Double-click **Network Connections**. An icon displays under Internet Gateway.
2. Right-click the icon and select **Properties**.

Figure 151 Network Connections



3. In the **Internet Connection Properties** window, click **Settings** to see the port mappings there were automatically created.

Figure 152 Internet Connection Properties

Internet Connection Properties
General
Connect to the Internet using:
Internet Connection
This connection allows you to connect to the Internet through a shared connection on another computer.
Settings...
Show icon in notification area when connected
OK
Cancel

4 You may edit or delete the port mappings or click **Add** to manually add port mappings.

Figure 153 Internet Connection Properties: Advanced Settings

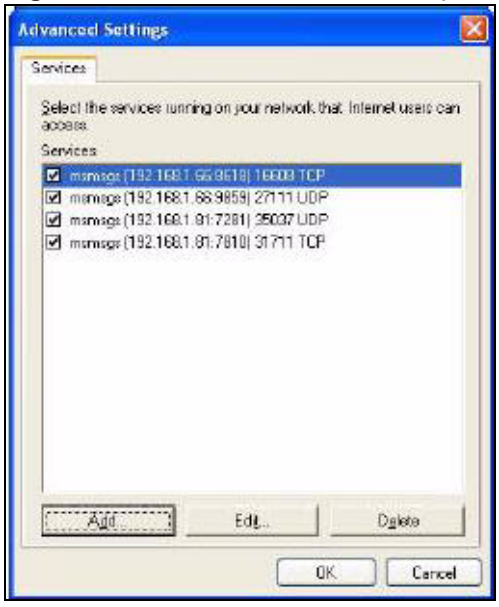
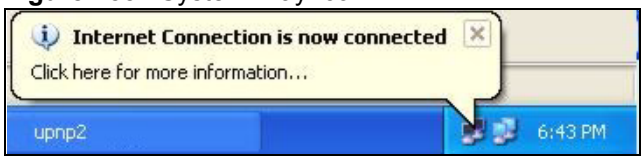


Figure 154 Internet Connection Properties: Advanced Settings: Add

When the UPnP-enabled device is disconnected from your computer, all port mappings will be deleted automatically.

5 Select **Show icon in notification area when connected** option and click **OK**. An icon displays in the system tray.

Figure 155 System Tray Icon



6 Double-click on the icon to display your current Internet connection status.

Figure 156 Internet Connection Status

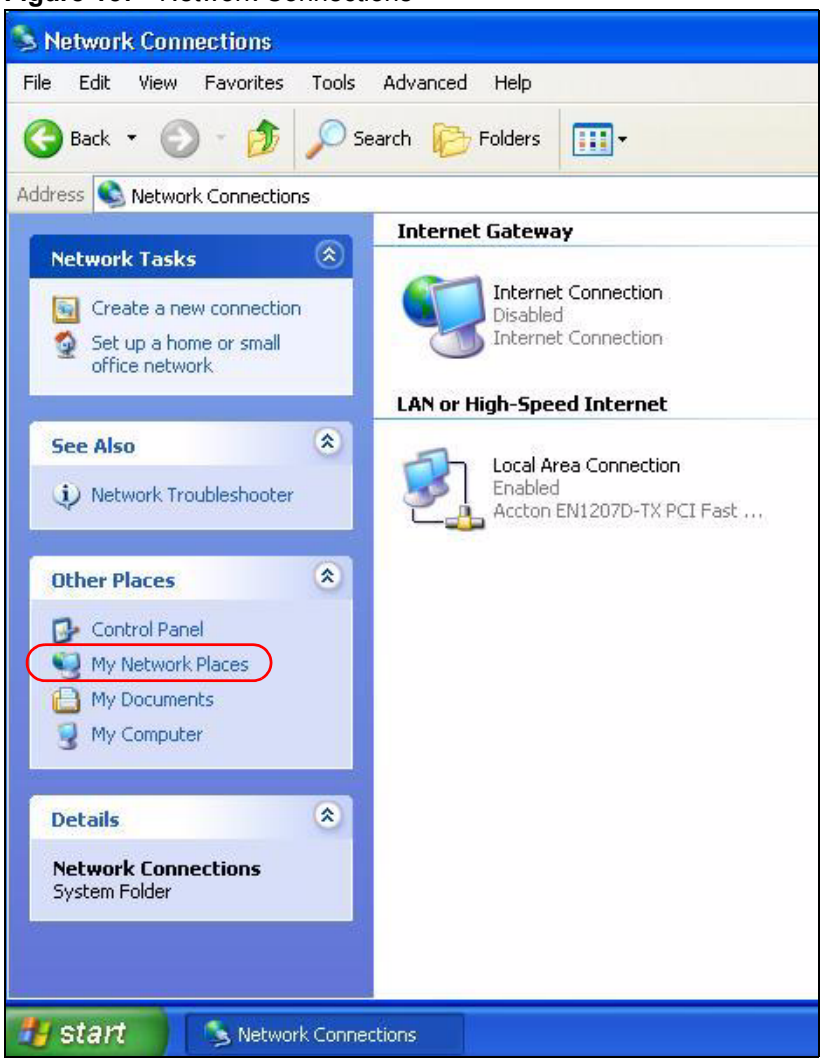
18.4.2 Web Configurator Easy Access

With UPnP, you can access the web-based configurator on the ZyXEL Device without finding out the IP address of the ZyXEL Device first. This comes helpful if you do not know the IP address of the ZyXEL Device.

Follow the steps below to access the web configurator.

1. Click **Start** and then **Control Panel**.
2. Double-click **Network Connections**.
3. Select **My Network Places** under **Other Places**.

Figure 157 Network Connections



4 An icon with the description for each UPnP-enabled device displays under **Local Network**.

5 Right-click on the icon for your ZyXEL Device and select **Invoke**. The web configurator login screen displays.

Figure 158 Network Connections: My Network Places

6 Right-click on the icon for your ZyXEL Device and select **Properties**. A properties window displays with basic information about the ZyXEL Device.

Figure 159 Network Connections: My Network Places: Properties: Example

PART VI
Maintenance

System (247)
Logs (253)
Tools (271)
Diagnostic (277)

19

System

Use this screen to configure the ZyXEL Device's time and date settings.

19.1 General Setup

19.1.1 General Setup and System Name

General Setup contains administrative and system-related information. **System Name** is for identification purposes. However, because some ISPs check this name you should enter your computer's "Computer Name".

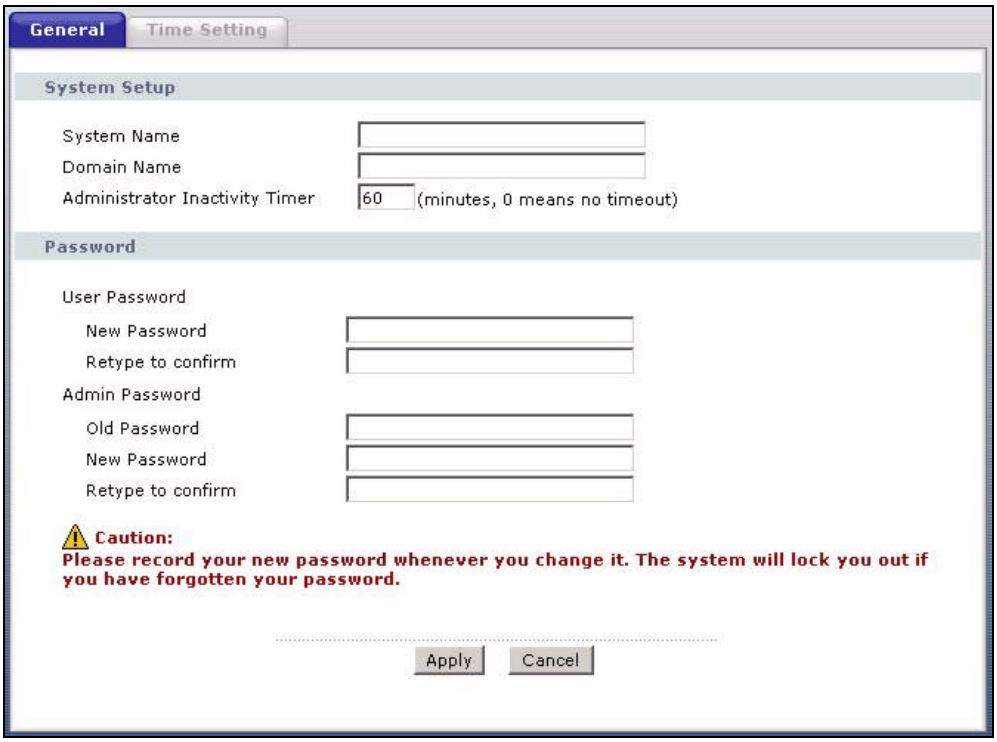
- In Windows 95/98 click **Start**, **Settings**, **Control Panel**, **Network**. Click the Identification tab, note the entry for the **Computer Name** field and enter it as the **System Name**.
- In Windows 2000, click **Start**, **Settings**, **Control Panel** and then double-click **System**. Click the **Network Identification** tab and then the **Properties** button. Note the entry for the **Computer name** field and enter it as the **System Name**.
- In Windows XP, click **start**, **My Computer**, **View system information** and then click the **Computer Name** tab. Note the entry in the **Full computer name** field and enter it as the ZyXEL Device **System Name**.

19.1.2 General Setup

The **Domain Name** entry is what is propagated to the DHCP clients on the LAN. If you leave this blank, the domain name obtained by DHCP from the ISP is used. While you must enter the host name (System Name), the domain name can be assigned from the ZyXEL Device via DHCP.

Click **Maintenance > System** to open the **General** screen.

Figure 160 System General Setup



The following table describes the labels in this screen.

Table 97 System General Setup

LABEL	DESCRIPTION
System Setup	
System Name	Choose a descriptive name for identification purposes. It is recommended you enter your computer's "Computer name" in this field. This name can be up to 30 alphanumeric characters long. Spaces are not allowed, but dashes "-" and underscores "_" are accepted.
Domain Name	Enter the domain name (if you know it) here. If you leave this field blank, the ISP may assign a domain name via DHCP. The domain name entered by you is given priority over the ISP assigned domain name.
Administrator Inactivity Timer	Type how many minutes a management session can be left idle before the session times out. The default is 5 minutes. After it times out you have to log in with your password again. Very long idle timeouts may have security risks. A value of "0" means a management session never times out, no matter how long it has been left idle (not recommended).
Password	
User Password	If you log in with the user password, you can only view the ZyXEL Device status. The default user password is **user**.
New Password	Type your new system password (up to 30 characters). Note that as you type a password, the screen displays a (*) for each character you type. After you change the password, use the new password to access the ZyXEL Device.
Retype to Confirm	Type the new password again for confirmation.
Admin Password	If you log in with the admin password, you can configure the advanced features as well as the wizard setup on the ZyXEL Device.

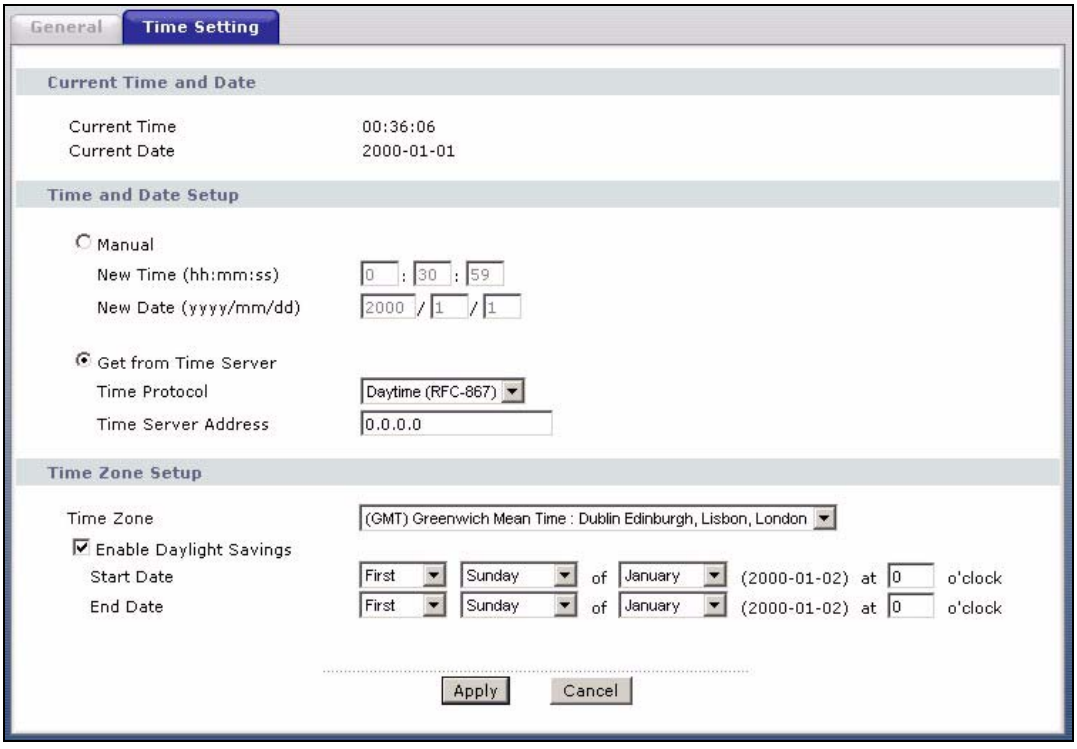
Table 97 System General Setup

LABEL	DESCRIPTION
Old Password	Type the default admin password (**1234**) or the existing password you use to access the system for configuring advanced features.
New Password	Type your new system password (up to 30 characters). Note that as you type a password, the screen displays a (*) for each character you type. After you change the password, use the new password to access the ZyXEL Device.
Retype to Confirm	Type the new password again for confirmation.
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.

19.2 Time Setting

To change your ZyXEL Device's time and date, click **Maintenance > System > Time Setting**. The screen appears as shown. Use this screen to configure the ZyXEL Device's time based on your local time zone.

Figure 161 System Time Setting



The following table describes the fields in this screen.

Table 98 System Time Setting

LABEL	DESCRIPTION
Current Time and Date	
Current Time	This field displays the time of your ZyXEL Device. Each time you reload this page, the ZyXEL Device synchronizes the time with the time server.
Current Date	This field displays the date of your ZyXEL Device. Each time you reload this page, the ZyXEL Device synchronizes the date with the time server.
Time and Date Setup	
Manual	Select this radio button to enter the time and date manually. If you configure a new time and date, Time Zone and Daylight Saving at the same time, the new time and date you entered has priority and the Time Zone and Daylight Saving settings do not affect it. When you enter the time settings manually, the ZyXEL Device uses the new setting once you click **Apply**. Note: If you enter time settings manually, they revert to their defaults when power is lost.
New Time (hh:mm:ss)	This field displays the last updated time from the time server or the last time configured manually. When you set **Time and Date Setup** to **Manual**, enter the new time in this field and then click **Apply**.
New Date (yyyy/mm/dd)	This field displays the last updated date from the time server or the last date configured manually. When you set **Time and Date Setup** to **Manual**, enter the new date in this field and then click **Apply**.
Get from Time Server	Select this radio button to have the ZyXEL Device get the time and date from the time server you specified below.
Time Protocol	Select the time service protocol that your time server uses. Not all time servers support all protocols, so you may have to check with your ISP/network administrator or use trial and error to find a protocol that works. The main difference between them is the format. **Daytime (RFC 867)** format is day/month/year/time zone of the server. **Time (RFC 868)** format displays a 4-byte integer giving the total number of seconds since 1970/1/1 at 0:0:0. The default, **NTP (RFC 1305)**, is similar to Time (RFC 868).
Time Server Address	Enter the IP address or URL (up to 20 extended ASCII characters in length) of your time server. Check with your ISP/network administrator if you are unsure of this information.
Time Zone Setup	
Time Zone	Choose the time zone of your location. This will set the time difference between your time zone and Greenwich Mean Time (GMT).
Enable Daylight Savings	Daylight saving is a period from late spring to early fall when many countries set their clocks ahead of normal local time by one hour to give more daytime light in the evening. Select this option if you use Daylight Saving Time.

Table 98 System Time Setting (continued)

LABEL	DESCRIPTION
Start Date	Configure the day and time when Daylight Saving Time starts if you selected **Enable Daylight Saving**. The **o'clock** field uses the 24 hour format. Here are a couple of examples: Daylight Saving Time starts in most parts of the United States on the second Sunday of March. Each time zone in the United States starts using Daylight Saving Time at 2 A.M. local time. So in the United States you would select **Second**, **Sunday**, **March** and **2:00**. Daylight Saving Time starts in the European Union on the last Sunday of March. All of the time zones in the European Union start using Daylight Saving Time at the same moment (1 A.M. GMT or UTC). So in the European Union you would select **Last**, **Sunday**, **March**. The time you type in the **o'clock** field depends on your time zone. In Germany for instance, you would type 2 because Germany's time zone is one hour ahead of GMT or UTC (GMT+1).
End Date	Configure the day and time when Daylight Saving Time ends if you selected **Enable Daylight Saving**. The **o'clock** field uses the 24 hour format. Here are a couple of examples: Daylight Saving Time ends in the United States on the first Sunday of November. Each time zone in the United States stops using Daylight Saving Time at 2 A.M. local time. So in the United States you would select **First**, **Sunday**, **November** and **2:00**. Daylight Saving Time ends in the European Union on the last Sunday of October. All of the time zones in the European Union stop using Daylight Saving Time at the same moment (1 A.M. GMT or UTC). So in the European Union you would select **Last**, **Sunday**, **October**. The time you type in the **o'clock** field depends on your time zone. In Germany for instance, you would type 2 because Germany's time zone is one hour ahead of GMT or UTC (GMT+1).
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.

20 Logs

This chapter contains information about configuring general log settings and viewing the ZyXEL Device's logs. Refer to the appendix for example log message explanations.

20.1 Logs Overview

The web configurator allows you to choose which categories of events and/or alerts to have the ZyXEL Device log and then display the logs or have the ZyXEL Device send them to an administrator (as e-mail) or to a syslog server.

20.1.1 Alerts and Logs

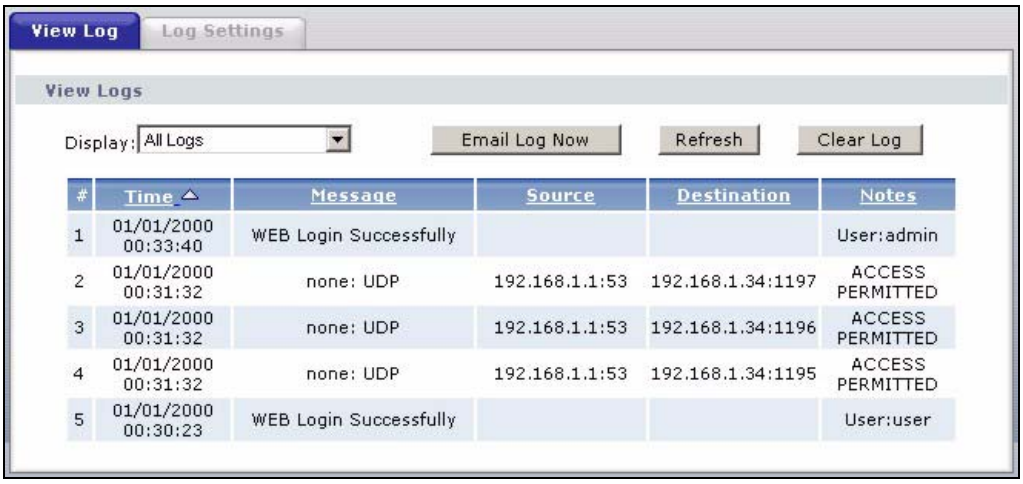
An alert is a type of log that warrants more serious attention. They include system errors, attacks (access control) and attempted access to blocked web sites. Some categories such as **System Errors** consist of both logs and alerts. You may differentiate them by their color in the **View Log** screen. Alerts display in red and logs display in black.

20.2 Viewing the Logs

Click **Maintenance > Logs** to open the **View Log** screen. Use the **View Log** screen to see the logs for the categories that you selected in the **Log Settings** screen (see Section 20.3 on page 254).

Log entries in red indicate alerts. The log wraps around and deletes the old entries after it fills. Click a column heading to sort the entries. A triangle indicates ascending or descending sort order.

Figure 162 View Log


View Log
Log Settings
View Logs
Display: All Logs
Email Log Now
Refresh
Clear Log
Time Message Source Destination Notes
1 01/01/2000 00:33:40 WEB Login Successfully User:admin
2 01/01/2000 00:31:32 none: UDP 192.168.1.1:53 192.168.1.34:1197 ACCESS PERMITTED
3 01/01/2000 00:31:32 none: UDP 192.168.1.1:53 192.168.1.34:1196 ACCESS PERMITTED
4 01/01/2000 00:31:32 none: UDP 192.168.1.1:53 192.168.1.34:1195 ACCESS PERMITTED
5 01/01/2000 00:30:23 WEB Login Successfully User:user

The following table describes the fields in this screen.

Table 99 View Log

LABEL	DESCRIPTION
Display	The categories that you select in the **Log Settings** screen display in the drop-down list box. Select a category of logs to view; select **All Logs** to view logs from all of the log categories that you selected in the **Log Settings** page.
Time	This field displays the time the log was recorded.
Message	This field states the reason for the log.
Source	This field lists the source IP address and the port number of the incoming packet.
Destination	This field lists the destination IP address and the port number of the incoming packet.
Notes	This field displays additional information about the log entry.
Email Log Now	Click **Email Log Now** to send the log screen to the e-mail address specified in the **Log Settings** page (make sure that you have first filled in the **E-mail Log Settings** fields in **Log Settings**).
Refresh	Click **Refresh** to renew the log screen.
Clear Log	Click **Clear Log** to delete all the logs.

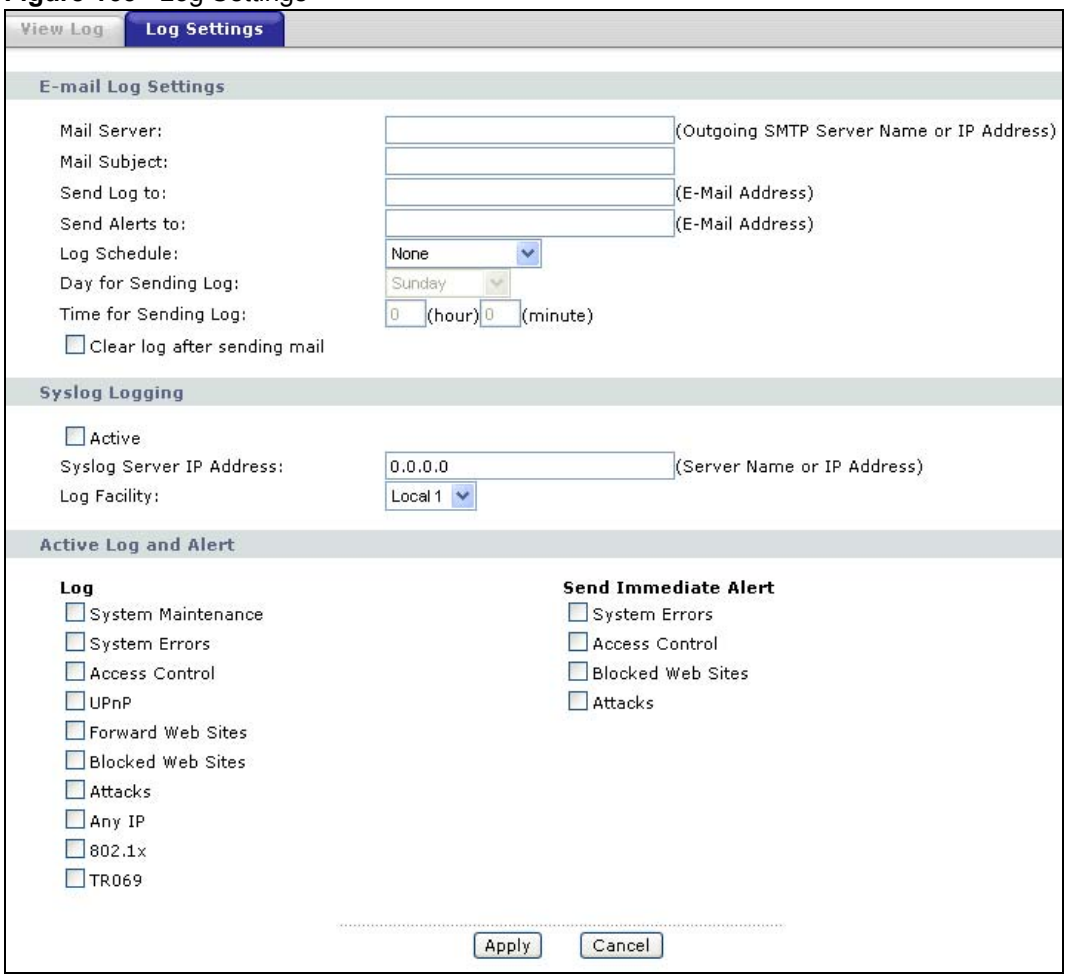
20.3 Configuring Log Settings

Use the **Log Settings** screen to configure to where the ZyXEL Device is to send logs; the schedule for when the ZyXEL Device is to send the logs and which logs and/or immediate alerts the ZyXEL Device is to record. See Section 20.1 on page 253 for more information.

To change your ZyXEL Device's log settings, click **Maintenance > Logs** > **Log Settings**. The screen appears as shown.

Alerts are e-mailed as soon as they happen. Logs may be e-mailed as soon as the log is full. Selecting many alert and/or log categories (especially **Access Control**) may result in many e-mails being sent.

Figure 163 Log Settings



The following table describes the fields in this screen.

Table 100 Log Settings

LABEL	DESCRIPTION
E-mail Log Settings	
Mail Server	Enter the server name or the IP address of the mail server for the e-mail addresses specified below. If this field is left blank, logs and alert messages will not be sent via E-mail.
Mail Subject	Type a title that you want to be in the subject line of the log e-mail message that the ZyXEL Device sends. Not all ZyXEL models have this field.
Send Log To	The ZyXEL Device sends logs to the e-mail address specified in this field. If this field is left blank, the ZyXEL Device does not send logs via e-mail.
Send Alerts To	Alerts are real-time notifications that are sent as soon as an event, such as a DoS attack, system error, or forbidden web access attempt occurs. Enter the E-mail address where the alert messages will be sent. Alerts include system errors, attacks and attempted access to blocked web sites. If this field is left blank, alert messages will not be sent via E-mail.

Table 100 Log Settings

LABEL	DESCRIPTION
Log Schedule	This drop-down menu is used to configure the frequency of log messages being sent as E-mail: • Daily • Weekly • Hourly • When Log is Full • None. If you select **Weekly** or **Daily**, specify a time of day when the E-mail should be sent. If you select **Weekly**, then also specify which day of the week the E-mail should be sent. If you select **When Log is Full**, an alert is sent when the log fills up. If you select **None**, no log messages are sent.
Day for Sending Log	Use the drop down list box to select which day of the week to send the logs.
Time for Sending Log	Enter the time of the day in 24-hour format (for example 23:00 equals 11:00 pm) to send the logs.
Clear log after sending mail	Select the checkbox to delete all the logs after the ZyXEL Device sends an E-mail of the logs.
Syslog Logging	The ZyXEL Device sends a log to an external syslog server.
Active	Click **Active** to enable syslog logging.
Syslog Server IP Address	Enter the server name or IP address of the syslog server that will log the selected categories of logs.
Log Facility	Select a location from the drop down list box. The log facility allows you to log the messages to different files in the syslog server. Refer to the syslog server manual for more information.
Active Log and Alert	
Log	Select the categories of logs that you want to record.
Send Immediate Alert	Select log categories for which you want the ZyXEL Device to send E-mail alerts immediately.
Apply	Click **Apply** to save your customized settings and exit this screen.
Cancel	Click **Cancel** to return to the previously saved settings.

20.3.1 Example E-mail Log

An "End of Log" message displays for each mail in which a complete log has been sent. The following is an example of a log sent by e-mail.

- You may edit the subject title.
- The date format here is Day-Month-Year.
- The date format here is Month-Day-Year. The time format is Hour-Minute-Second.
- "`End of Log`" message shows that a complete log has been sent.

Figure 164 E-mail Log Example

```
Subject:
        Firewall Alert From xxxxx
   Date:
        Fri, 07 Apr 2000 10:05:42
   From:
        user@zyxel.com
     To:
        user@zyxel.com
  1|Apr  7 00 |From:192.168.1.1     To:192.168.1.255   |default policy  |forward
   | 09:54:03 |UDP     src port:00520 dest port:00520  |<1,00>          |
  2|Apr  7 00 |From:192.168.1.131   To:192.168.1.255   |default policy  |forward
   | 09:54:17 |UDP     src port:00520 dest port:00520  |<1,00>          |
  3|Apr  7 00 |From:192.168.1.6     To:10.10.10.10 |match           |forward
   | 09:54:19 |UDP     src port:03516 dest port:00053  |<1,01>          |
……..{snip}……..
……..{snip}……..
126|Apr  7 00 |From:192.168.1.1     To:192.168.1.255   |match           |forward
   | 10:05:00 |UDP     src port:00520 dest port:00520  |<1,02>          |
127|Apr  7 00 |From:192.168.1.131   To:192.168.1.255   |match           |forward
   | 10:05:17 |UDP     src port:00520 dest port:00520  |<1,02>          |
128|Apr  7 00 |From:192.168.1.1     To:192.168.1.255   |match           |forward
   | 10:05:30 |UDP     src port:00520 dest port:00520  |<1,02>          |
End of Firewall Log
```

20.4 Log Descriptions

This section provides descriptions of example log messages.

Table 101 System Maintenance Logs

LOG MESSAGE	DESCRIPTION
Time calibration is successful	The router has adjusted its time based on information from the time server.
Time calibration failed	The router failed to get information from the time server.
WAN interface gets IP:%s	A WAN interface got a new IP address from the DHCP, PPPoE, PPTP or dial-up server.
DHCP client IP expired	A DHCP client's IP address has expired.
DHCP server assigns%s	The DHCP server assigned an IP address to a client.
Successful WEB login	Someone has logged on to the router's web configurator interface.
WEB login failed	Someone has failed to log on to the router's web configurator interface.
Successful TELNET login	Someone has logged on to the router via telnet.
TELNET login failed	Someone has failed to log on to the router via telnet.
Successful FTP login	Someone has logged on to the router via ftp.
FTP login failed	Someone has failed to log on to the router via ftp.
NAT Session Table is Full!	The maximum number of NAT session table entries has been exceeded and the table is full.

Table 101 System Maintenance Logs (continued)

LOG MESSAGE	DESCRIPTION
Starting Connectivity Monitor	Starting Connectivity Monitor.
Time initialized by Daytime Server	The router got the time and date from the Daytime server.
Time initialized by Time server	The router got the time and date from the time server.
Time initialized by NTP server	The router got the time and date from the NTP server.
Connect to Daytime server fail	The router was not able to connect to the Daytime server.
Connect to Time server fail	The router was not able to connect to the Time server.
Connect to NTP server fail	The router was not able to connect to the NTP server.
Too large ICMP packet has been dropped	The router dropped an ICMP packet that was too large.
Configuration Change: PC = 0x%x, Task ID = 0x%x	The router is saving configuration changes.
Successful SSH login	Someone has logged on to the router's SSH server.
SSH login failed	Someone has failed to log on to the router's SSH server.
Successful HTTPS login	Someone has logged on to the router's web configurator interface using HTTPS protocol.
HTTPS login failed	Someone has failed to log on to the router's web configurator interface using HTTPS protocol.

Table 102 System Error Logs

LOG MESSAGE	DESCRIPTION
%s exceeds the max. number of session per host!	This attempt to create a NAT session exceeds the maximum number of NAT session table entries allowed to be created per host.
setNetBIOSFilter: calloc error	The router failed to allocate memory for the NetBIOS filter settings.
readNetBIOSFilter: calloc error	The router failed to allocate memory for the NetBIOS filter settings.
WAN connection is down.	A WAN connection is down. You cannot access the network through this interface.

Table 103 Access Control Logs

LOG MESSAGE	DESCRIPTION
Firewall default policy: [TCP | UDP | IGMP | ESP | GRE | OSPF] <Packet Direction>	Attempted TCP/UDP/IGMP/ESP/GRE/OSPF access matched the default policy and was blocked or forwarded according to the default policy's setting.
Firewall rule [NOT] match:[TCP | UDP | IGMP | ESP | GRE | OSPF] <Packet Direction>, <rule:%d>	Attempted TCP/UDP/IGMP/ESP/GRE/OSPF access matched (or did not match) a configured firewall rule (denoted by its number) and was blocked or forwarded according to the rule.

Table 103 Access Control Logs (continued)

LOG MESSAGE	DESCRIPTION
`Triangle route packet forwarded: [TCP | UDP | IGMP | ESP | GRE | OSPF]`	The firewall allowed a triangle route session to pass through.
`Packet without a NAT table entry blocked: [TCP | UDP | IGMP | ESP | GRE | OSPF]`	The router blocked a packet that didn't have a corresponding NAT table entry.
`Router sent blocked web site message: TCP`	The router sent a message to notify a user that the router blocked access to a web site that the user requested.

Table 104 TCP Reset Logs

LOG MESSAGE	DESCRIPTION
`Under SYN flood attack, sent TCP RST`	The router sent a TCP reset packet when a host was under a SYN flood attack (the TCP incomplete count is per destination host.)
`Exceed TCP MAX incomplete, sent TCP RST`	The router sent a TCP reset packet when the number of TCP incomplete connections exceeded the user configured threshold. (the TCP incomplete count is per destination host.) Note: Refer to **TCP Maximum Incomplete** in the **Firewall Attack Alerts** screen.
`Peer TCP state out of order, sent TCP RST`	The router sent a TCP reset packet when a TCP connection state was out of order.Note: The firewall refers to RFC793 Figure 6 to check the TCP state.
`Firewall session time out, sent TCP RST`	The router sent a TCP reset packet when a dynamic firewall session timed out. The default timeout values are as follows: ICMP idle timeout: 3 minutes UDP idle timeout: 3 minutes TCP connection (three way handshaking) timeout: 270 seconds TCP FIN-wait timeout: 2 MSL (Maximum Segment Lifetime set in the TCP header). TCP idle (established) timeout (s): 150 minutes TCP reset timeout: 10 seconds
`Exceed MAX incomplete, sent TCP RST`	The router sent a TCP reset packet when the number of incomplete connections (TCP and UDP) exceeded the user-configured threshold. (Incomplete count is for all TCP and UDP connections through the firewall.)Note: When the number of incomplete connections (TCP + UDP) > “Maximum Incomplete High”, the router sends TCP RST packets for TCP connections and destroys TOS (firewall dynamic sessions) until incomplete connections < “Maximum Incomplete Low”.
`Access block, sent TCP RST`	The router sends a TCP RST packet and generates this log if you turn on the firewall TCP reset mechanism (via CI command: "sys firewall tcprst").

Table 105 Packet Filter Logs

LOG MESSAGE	DESCRIPTION
`[TCP | UDP | ICMP | IGMP | Generic] packet filter matched (set:%d, rule:%d)`	Attempted access matched a configured filter rule (denoted by its set and rule number) and was blocked or forwarded according to the rule.

Table 106 ICMP Logs

LOG MESSAGE	DESCRIPTION
`Firewall default policy: ICMP <Packet Direction>, <type:%d>, <code:%d>`	ICMP access matched the default policy and was blocked or forwarded according to the user's setting. For type and code details, see Table 118 on page 268.
`Firewall rule [NOT] match: ICMP <Packet Direction>, <rule:%d>, <type:%d>, <code:%d>`	ICMP access matched (or didn't match) a firewall rule (denoted by its number) and was blocked or forwarded according to the rule. For type and code details, see Table 118 on page 268.
`Triangle route packet forwarded: ICMP`	The firewall allowed a triangle route session to pass through.
`Packet without a NAT table entry blocked: ICMP`	The router blocked a packet that didn't have a corresponding NAT table entry.
`Unsupported/out-of-order ICMP: ICMP`	The firewall does not support this kind of ICMP packets or the ICMP packets are out of order.
`Router reply ICMP packet: ICMP`	The router sent an ICMP reply packet to the sender.

Table 107 CDR Logs

LOG MESSAGE	DESCRIPTION
`board%d line%d channel%d, call%d,%s C01 Outgoing Call dev=%x ch=%x%s`	The router received the setup requirements for a call. "call" is the reference (count) number of the call. "dev" is the device type (3 is for dial-up, 6 is for PPPoE, 10 is for PPTP). "channel" or "ch" is the call channel ID.For example,"board 0 line 0 channel 0, call 3, C01 Outgoing Call dev=6 ch=0 "Means the router has dialed to the PPPoE server 3 times.
`board%d line%d channel%d, call%d,%s C02 OutCall Connected%d%s`	The PPPoE, PPTP or dial-up call is connected.
`board%d line%d channel%d, call%d,%s C02 Call Terminated`	The PPPoE, PPTP or dial-up call was disconnected.

Table 108 PPP Logs

LOG MESSAGE	DESCRIPTION
`ppp:LCP Starting`	The PPP connection's Link Control Protocol stage has started.
`ppp:LCP Opening`	The PPP connection's Link Control Protocol stage is opening.
`ppp:CHAP Opening`	The PPP connection's Challenge Handshake Authentication Protocol stage is opening.
`ppp:IPCP Starting`	The PPP connection's Internet Protocol Control Protocol stage is starting.
`ppp:IPCP Opening`	The PPP connection's Internet Protocol Control Protocol stage is opening.
`ppp:LCP Closing`	The PPP connection's Link Control Protocol stage is closing.
`ppp:IPCP Closing`	The PPP connection's Internet Protocol Control Protocol stage is closing.

Table 109 UPnP Logs

LOG MESSAGE	DESCRIPTION
UPnP pass through Firewall	UPnP packets can pass through the firewall.

Table 110 Content Filtering Logs

LOG MESSAGE	DESCRIPTION
%s: Keyword blocking	The content of a requested web page matched a user defined keyword.
%s: Not in trusted web list	The web site is not in a trusted domain, and the router blocks all traffic except trusted domain sites.
%s: Forbidden Web site	The web site is in the forbidden web site list.
%s: Contains ActiveX	The web site contains ActiveX.
%s: Contains Java applet	The web site contains a Java applet.
%s: Contains cookie	The web site contains a cookie.
%s: Proxy mode detected	The router detected proxy mode in the packet.
%s	The content filter server responded that the web site is in the blocked category list, but it did not return the category type.
%s:%s	The content filter server responded that the web site is in the blocked category list, and returned the category type.
%s(cache hit)	The system detected that the web site is in the blocked list from the local cache, but does not know the category type.
%s:%s(cache hit)	The system detected that the web site is in blocked list from the local cache, and knows the category type.
%s: Trusted Web site	The web site is in a trusted domain.
%s	When the content filter is not on according to the time schedule or you didn't select the "Block Matched Web Site" check box, the system forwards the web content.
Waiting content filter server timeout	The external content filtering server did not respond within the timeout period.
DNS resolving failed	The ZyXEL Device cannot get the IP address of the external content filtering via DNS query.
Creating socket failed	The ZyXEL Device cannot issue a query because TCP/IP socket creation failed, port:port number.
Connecting to content filter server fail	The connection to the external content filtering server failed.
License key is invalid	The external content filtering license key is invalid.

Table 111 Attack Logs

LOG MESSAGE	DESCRIPTION
attack [TCP | UDP | IGMP | ESP | GRE | OSPF]	The firewall detected a TCP/UDP/IGMP/ESP/GRE/OSPF attack.
attack ICMP (type:%d, code:%d)	The firewall detected an ICMP attack. For type and code details, see Table 118 on page 268.
land [TCP | UDP | IGMP | ESP | GRE | OSPF]	The firewall detected a TCP/UDP/IGMP/ESP/GRE/OSPF land attack.
land ICMP (type:%d, code:%d)	The firewall detected an ICMP land attack. For type and code details, see Table 118 on page 268.
ip spoofing - WAN [TCP | UDP | IGMP | ESP | GRE | OSPF]	The firewall detected an IP spoofing attack on the WAN port.
ip spoofing - WAN ICMP (type:%d, code:%d)	The firewall detected an ICMP IP spoofing attack on the WAN port. For type and code details, see Table 118 on page 268.
icmp echo: ICMP (type:%d, code:%d)	The firewall detected an ICMP echo attack. For type and code details, see Table 118 on page 268.
syn flood TCP	The firewall detected a TCP syn flood attack.
ports scan TCP	The firewall detected a TCP port scan attack.
teardrop TCP	The firewall detected a TCP teardrop attack.
teardrop UDP	The firewall detected an UDP teardrop attack.
teardrop ICMP (type:%d, code:%d)	The firewall detected an ICMP teardrop attack. For type and code details, see Table 118 on page 268.
illegal command TCP	The firewall detected a TCP illegal command attack.
NetBIOS TCP	The firewall detected a TCP NetBIOS attack.
ip spoofing - no routing entry [TCP | UDP | IGMP | ESP | GRE | OSPF]	The firewall classified a packet with no source routing entry as an IP spoofing attack.
ip spoofing - no routing entry ICMP (type:%d, code:%d)	The firewall classified an ICMP packet with no source routing entry as an IP spoofing attack.
vulnerability ICMP (type:%d, code:%d)	The firewall detected an ICMP vulnerability attack. For type and code details, see Table 118 on page 268.
traceroute ICMP (type:%d, code:%d)	The firewall detected an ICMP traceroute attack. For type and code details, see Table 118 on page 268.

Table 112 IPSec Logs

LOG MESSAGE	DESCRIPTION
Discard REPLAY packet	The router received and discarded a packet with an incorrect sequence number.
Inbound packet authentication failed	The router received a packet that has been altered. A third party may have altered or tampered with the packet.
Receive IPSec packet, but no corresponding tunnel exists	The router dropped an inbound packet for which SPI could not find a corresponding phase 2 SA.

Table 112 IPSec Logs (continued)

LOG MESSAGE	DESCRIPTION
Rule <%d> idle time out, disconnect	The router dropped a connection that had outbound traffic and no inbound traffic for a certain time period. You can use the "ipsec timer chk_conn" CI command to set the time period. The default value is 2 minutes.
WAN IP changed to <IP>	The router dropped all connections with the “MyIP” configured as “0.0.0.0” when the WAN IP address changed.

Table 113 IKE Logs

LOG MESSAGE	DESCRIPTION
Active connection allowed exceeded	The IKE process for a new connection failed because the limit of simultaneous phase 2 SAs has been reached.
Start Phase 2: Quick Mode	Phase 2 Quick Mode has started.
Verifying Remote ID failed:	The connection failed during IKE phase 2 because the router and the peer’s Local/Remote Addresses don’t match.
Verifying Local ID failed:	The connection failed during IKE phase 2 because the router and the peer’s Local/Remote Addresses don’t match.
IKE Packet Retransmit	The router retransmitted the last packet sent because there was no response from the peer.
Failed to send IKE Packet	An Ethernet error stopped the router from sending IKE packets.
Too many errors! Deleting SA	An SA was deleted because there were too many errors.
Phase 1 IKE SA process done	The phase 1 IKE SA process has been completed.
Duplicate requests with the same cookie	The router received multiple requests from the same peer while still processing the first IKE packet from the peer.
IKE Negotiation is in process	The router has already started negotiating with the peer for the connection, but the IKE process has not finished yet.
No proposal chosen	Phase 1 or phase 2 parameters don’t match. Please check all protocols / settings. Ex. One device being configured for 3DES and the other being configured for DES causes the connection to fail.
Local / remote IPs of incoming request conflict with rule <%d>	The security gateway is set to “0.0.0.0” and the router used the peer’s “Local Address” as the router’s “Remote Address”. This information conflicted with static rule #d; thus the connection is not allowed.
Cannot resolve Secure Gateway Addr for rule <%d>	The router couldn’t resolve the IP address from the domain name that was used for the secure gateway address.
Peer ID: <peer id> <My remote type> -<My local type>	The displayed ID information did not match between the two ends of the connection.
vs. My Remote <My remote> -<My remote>	The displayed ID information did not match between the two ends of the connection.
vs. My Local <My local>-<My local>	The displayed ID information did not match between the two ends of the connection.
Send <packet>	A packet was sent.

Table 113 IKE Logs (continued)

LOG MESSAGE	DESCRIPTION
Recv <packet>	IKE uses ISAKMP to transmit data. Each ISAKMP packet contains many different types of payloads. All of them show in the LOG. Refer to RFC2408 – ISAKMP for a list of all ISAKMP payload types.
Recv <Main or Aggressive> Mode request from <IP>	The router received an IKE negotiation request from the peer address specified.
Send <Main or Aggressive> Mode request to <IP>	The router started negotiation with the peer.
Invalid IP <Peer local> / <Peer local>	The peer's "Local IP Address" is invalid.
Remote IP <Remote IP> / <Remote IP> conflicts	The security gateway is set to "0.0.0.0" and the router used the peer's "Local Address" as the router's "Remote Address". This information conflicted with static rule #d; thus the connection is not allowed.
Phase 1 ID type mismatch	This router's "Peer ID Type" is different from the peer IPSec router's "Local ID Type".
Phase 1 ID content mismatch	This router's "Peer ID Content" is different from the peer IPSec router's "Local ID Content".
No known phase 1 ID type found	The router could not find a known phase 1 ID in the connection attempt.
ID type mismatch. Local / Peer: <Local ID type/Peer ID type>	The phase 1 ID types do not match.
ID content mismatch	The phase 1 ID contents do not match.
Configured Peer ID Content: <Configured Peer ID Content>	The phase 1 ID contents do not match and the configured "Peer ID Content" is displayed.
Incoming ID Content: <Incoming Peer ID Content>	The phase 1 ID contents do not match and the incoming packet's ID content is displayed.
Unsupported local ID Type: <%d>	The phase 1 ID type is not supported by the router.
Build Phase 1 ID	The router has started to build the phase 1 ID.
Adjust TCP MSS to%d	The router automatically changed the TCP Maximum Segment Size value after establishing a tunnel.
Rule <%d> input idle time out, disconnect	The tunnel for the listed rule was dropped because there was no inbound traffic within the idle timeout period.
XAUTH succeed! Username: <Username>	The router used extended authentication to authenticate the listed username.
XAUTH fail! Username: <Username>	The router was not able to use extended authentication to authenticate the listed username.
Rule[%d] Phase 1 negotiation mode mismatch	The listed rule's IKE phase 1 negotiation mode did not match between the router and the peer.
Rule [%d] Phase 1 encryption algorithm mismatch	The listed rule's IKE phase 1 encryption algorithm did not match between the router and the peer.
Rule [%d] Phase 1 authentication algorithm mismatch	The listed rule's IKE phase 1 authentication algorithm did not match between the router and the peer.

Table 113 IKE Logs (continued)

LOG MESSAGE	DESCRIPTION
Rule [%d] Phase 1 authentication method mismatch	The listed rule's IKE phase 1 authentication method did not match between the router and the peer.
Rule [%d] Phase 1 key group mismatch	The listed rule's IKE phase 1 key group did not match between the router and the peer.
Rule [%d] Phase 2 protocol mismatch	The listed rule's IKE phase 2 protocol did not match between the router and the peer.
Rule [%d] Phase 2 encryption algorithm mismatch	The listed rule's IKE phase 2 encryption algorithm did not match between the router and the peer.
Rule [%d] Phase 2 authentication algorithm mismatch	The listed rule's IKE phase 2 authentication algorithm did not match between the router and the peer.
Rule [%d] Phase 2 encapsulation mismatch	The listed rule's IKE phase 2 encapsulation did not match between the router and the peer.
Rule [%d]> Phase 2 pfs mismatch	The listed rule's IKE phase 2 perfect forward secret (pfs) setting did not match between the router and the peer.
Rule [%d] Phase 1 ID mismatch	The listed rule's IKE phase 1 ID did not match between the router and the peer.
Rule [%d] Phase 1 hash mismatch	The listed rule's IKE phase 1 hash did not match between the router and the peer.
Rule [%d] Phase 1 preshared key mismatch	The listed rule's IKE phase 1 pre-shared key did not match between the router and the peer.
Rule [%d] Tunnel built successfully	The listed rule's IPSec tunnel has been built successfully.
Rule [%d] Peer's public key not found	The listed rule's IKE phase 1 peer's public key was not found.
Rule [%d] Verify peer's signature failed	The listed rule's IKE phase 1verification of the peer's signature failed.
Rule [%d] Sending IKE request	IKE sent an IKE request for the listed rule.
Rule [%d] Receiving IKE request	IKE received an IKE request for the listed rule.
Swap rule to rule [%d]	The router changed to using the listed rule.
Rule [%d] Phase 1 key length mismatch	The listed rule's IKE phase 1 key length (with the AES encryption algorithm) did not match between the router and the peer.
Rule [%d] phase 1 mismatch	The listed rule's IKE phase 1 did not match between the router and the peer.
Rule [%d] phase 2 mismatch	The listed rule's IKE phase 2 did not match between the router and the peer.
Rule [%d] Phase 2 key length mismatch	The listed rule's IKE phase 2 key lengths (with the AES encryption algorithm) did not match between the router and the peer.

Table 114 PKI Logs

LOG MESSAGE	DESCRIPTION
Enrollment successful	The SCEP online certificate enrollment was successful. The Destination field records the certification authority server IP address and port.
Enrollment failed	The SCEP online certificate enrollment failed. The Destination field records the certification authority server's IP address and port.
Failed to resolve <SCEP CA server url>	The SCEP online certificate enrollment failed because the certification authority server's address cannot be resolved.
Enrollment successful	The CMP online certificate enrollment was successful. The Destination field records the certification authority server's IP address and port.
Enrollment failed	The CMP online certificate enrollment failed. The Destination field records the certification authority server's IP address and port.
Failed to resolve <CMP CA server url>	The CMP online certificate enrollment failed because the certification authority server's IP address cannot be resolved.
Rcvd ca cert: <subject name>	The router received a certification authority certificate, with subject name as recorded, from the LDAP server whose IP address and port are recorded in the Source field.
Rcvd user cert: <subject name>	The router received a user certificate, with subject name as recorded, from the LDAP server whose IP address and port are recorded in the Source field.
Rcvd CRL <size>: <issuer name>	The router received a CRL (Certificate Revocation List), with size and issuer name as recorded, from the LDAP server whose IP address and port are recorded in the Source field.
Rcvd ARL <size>: <issuer name>	The router received an ARL (Authority Revocation List), with size and issuer name as recorded, from the LDAP server whose address and port are recorded in the Source field.
Failed to decode the received ca cert	The router received a corrupted certification authority certificate from the LDAP server whose address and port are recorded in the Source field.
Failed to decode the received user cert	The router received a corrupted user certificate from the LDAP server whose address and port are recorded in the Source field.
Failed to decode the received CRL	The router received a corrupted CRL (Certificate Revocation List) from the LDAP server whose address and port are recorded in the Source field.
Failed to decode the received ARL	The router received a corrupted ARL (Authority Revocation List) from the LDAP server whose address and port are recorded in the Source field.
Rcvd data <size> too large! Max size allowed: <max size>	The router received directory data that was too large (the size is listed) from the LDAP server whose address and port are recorded in the Source field. The maximum size of directory data that the router allows is also recorded.
Cert trusted: <subject name>	The router has verified the path of the certificate with the listed subject name.
Due to <reason codes>, cert not trusted: <subject name>	Due to the reasons listed, the certificate with the listed subject name has not passed the path verification. The recorded reason codes are only approximate reasons for not trusting the certificate. Please see Table 115 on page 267 for the corresponding descriptions of the codes.

Table 115 Certificate Path Verification Failure Reason Codes

CODE	DESCRIPTION
1	Algorithm mismatch between the certificate and the search constraints.
2	Key usage mismatch between the certificate and the search constraints.
3	Certificate was not valid in the time interval.
4	(Not used)
5	Certificate is not valid.
6	Certificate signature was not verified correctly.
7	Certificate was revoked by a CRL.
8	Certificate was not added to the cache.
9	Certificate decoding failed.
10	Certificate was not found (anywhere).
11	Certificate chain looped (did not find trusted root).
12	Certificate contains critical extension that was not handled.
13	Certificate issuer was not valid (CA specific information missing).
14	(Not used)
15	CRL is too old.
16	CRL is not valid.
17	CRL signature was not verified correctly.
18	CRL was not found (anywhere).
19	CRL was not added to the cache.
20	CRL decoding failed.
21	CRL is not currently valid, but in the future.
22	CRL contains duplicate serial numbers.
23	Time interval is not continuous.
24	Time information not available.
25	Database method failed due to timeout.
26	Database method failed.
27	Path was not verified.
28	Maximum path length reached.

Table 116 802.1X Logs

LOG MESSAGE	DESCRIPTION
Local User Database accepts user.	A user was authenticated by the local user database.
Local User Database reports user credential error.	A user was not authenticated by the local user database because of an incorrect user password.
Local User Database does not find user`s credential.	A user was not authenticated by the local user database because the user is not listed in the local user database.
RADIUS accepts user.	A user was authenticated by the RADIUS Server.

Table 116 802.1X Logs (continued)

LOG MESSAGE	DESCRIPTION
RADIUS rejects user. Pls check RADIUS Server.	A user was not authenticated by the RADIUS Server. Please check the RADIUS Server.
Local User Database does not support authentication method.	The local user database only supports the EAP-MD5 method. A user tried to use another authentication method and was not authenticated.
User logout because of session timeout expired.	The router logged out a user whose session expired.
User logout because of user deassociation.	The router logged out a user who ended the session.
User logout because of no authentication response from user.	The router logged out a user from which there was no authentication response.
User logout because of idle timeout expired.	The router logged out a user whose idle timeout period expired.
User logout because of user request.	A user logged out.
Local User Database does not support authentication method.	A user tried to use an authentication method that the local user database does not support (it only supports EAP-MD5).
No response from RADIUS. Pls check RADIUS Server.	There is no response message from the RADIUS server, please check the RADIUS server.
Use Local User Database to authenticate user.	The local user database is operating as the authentication server.
Use RADIUS to authenticate user.	The RADIUS server is operating as the authentication server.
No Server to authenticate user.	There is no authentication server to authenticate a user.
Local User Database does not find user`s credential.	A user was not authenticated by the local user database because the user is not listed in the local user database.

Table 117 ACL Setting Notes

PACKET DIRECTION	DIRECTION	DESCRIPTION
(L to W)	LAN to WAN	ACL set for packets traveling from the LAN to the WAN.
(W to L)	WAN to LAN	ACL set for packets traveling from the WAN to the LAN.
(L to L)	LAN to LAN/ ZyXEL Device	ACL set for packets traveling from the LAN to the LAN or the ZyXEL Device.
(W to W)	WAN to WAN/ ZyXEL Device	ACL set for packets traveling from the WAN to the WAN or the ZyXEL Device.

Table 118 ICMP Notes

TYPE	CODE	DESCRIPTION
0		Echo Reply
	0	Echo reply message
3		Destination Unreachable

Table 118 ICMP Notes (continued)

TYPE	CODE	DESCRIPTION
	0	Net unreachable
	1	Host unreachable
	2	Protocol unreachable
	3	Port unreachable
	4	A packet that needed fragmentation was dropped because it was set to Don't Fragment (DF)
	5	Source route failed
4		Source Quench
	0	A gateway may discard internet datagrams if it does not have the buffer space needed to queue the datagrams for output to the next network on the route to the destination network.
5		Redirect
	0	Redirect datagrams for the Network
	1	Redirect datagrams for the Host
	2	Redirect datagrams for the Type of Service and Network
	3	Redirect datagrams for the Type of Service and Host
8		Echo
	0	Echo message
11		Time Exceeded
	0	Time to live exceeded in transit
	1	Fragment reassembly time exceeded
12		Parameter Problem
	0	Pointer indicates the error
13		Timestamp
	0	Timestamp request message
14		Timestamp Reply
	0	Timestamp reply message
15		Information Request
	0	Information request message
16		Information Reply
	0	Information reply message

Table 119 Syslog Logs

LOG MESSAGE	DESCRIPTION
<Facility*8 + Severity>Mon dd hr:mm:ss hostname src="<srcIP:srcPort>" dst="<dstIP:dstPort>" msg="<msg>" note="<note>" devID="<mac address last three numbers>" cat="<category>	"This message is sent by the system ("RAS" displays as the system name if you haven't configured one) when the router generates a syslog. The facility is defined in the web MAIN MENU->LOGS->Log Settings page. The severity is the log's syslog class. The definition of messages and notes are defined in the various log charts throughout this appendix. The "devID" is the last three characters of the MAC address of the router's LAN port. The "cat" is the same as the category in the router's logs.

The following table shows RFC-2408 ISAKMP payload types that the log displays. Please refer to the RFC for detailed information on each type.

Table 120 RFC-2408 ISAKMP Payload Types

LOG DISPLAY	PAYLOAD TYPE
SA	Security Association
PROP	Proposal
TRANS	Transform
KE	Key Exchange
ID	Identification
CER	Certificate
CER_REQ	Certificate Request
HASH	Hash
SIG	Signature
NONCE	Nonce
NOTFY	Notification
DEL	Delete
VID	Vendor ID

21 Tools

This chapter describes how to upload new firmware, manage configuration and restart your ZyXEL Device.

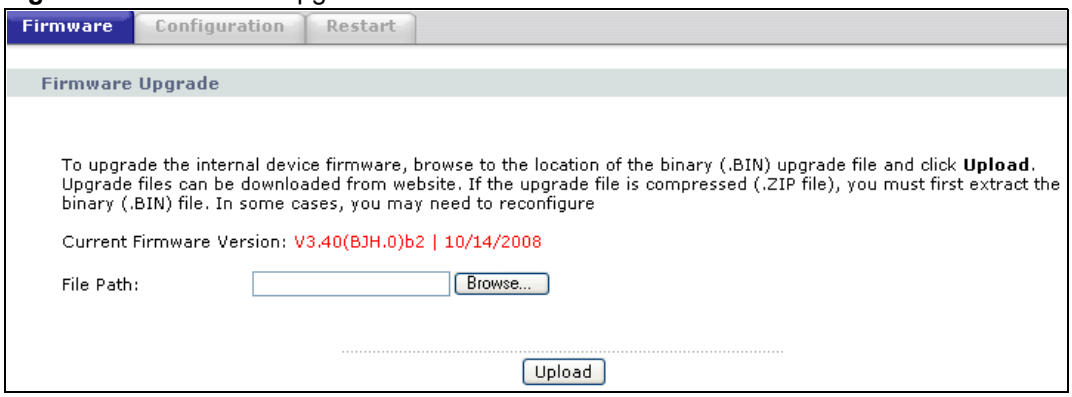
21.1 Firmware Upgrade

Find firmware at www.zyxel.com in a file that (usually) uses the system model name with a .bin extension, for example, "ZyXEL Device.bin". The upload process uses HTTP (Hypertext Transfer Protocol) and may take up to two minutes. After a successful upload, the system will reboot.

Only use firmware for your device's specific model. Refer to the label on the bottom of your device.

Click **Maintenance > Tools** to open the **Firmware** screen. Follow the instructions in this screen to upload firmware to your ZyXEL Device.

Figure 165 Firmware Upgrade


Firmware
Configuration
Restart
Firmware Upgrade
To upgrade the internal device firmware, browse to the location of the binary (.BIN) upgrade file and click Upload. Upgrade files can be downloaded from website. If the upgrade file is compressed (.ZIP file), you must first extract the binary (.BIN) file. In some cases, you may need to reconfigure
Current Firmware Version: V3.40(BJH.0)b2 | 10/14/2008
File Path:
Browse...
Upload

The following table describes the labels in this screen.

Table 121 Firmware Upgrade

LABEL	DESCRIPTION
Current Firmware Version	This is the present Firmware version and the date created.
File Path	Type in the location of the file you want to upload in this field or click **Browse ...** to find it.

Table 121 Firmware Upgrade (continued)

LABEL	DESCRIPTION
Browse...	Click **Browse...** to find the .bin file you want to upload. Remember that you must decompress compressed (.zip) files before you can upload them.
Upload	Click **Upload** to begin the upload process. This process may take up to two minutes.

Do NOT turn off the ZyXEL Device while firmware upload is in progress!

After you see the **Firmware Upload in Progress** screen, wait two minutes before logging into the ZyXEL Device again.

Figure 166 Firmware Upload In Progress

ZyXEL
Firmware Upload In Progress
Do not Turn Off the Device.
Please Wait ...
Please wait for the device to finish restarting(PWR LED is on steady). This should take about two minutes.
To access the device after a successful firmware upload, you need to log in again. Check your new firmware version in the system status menu.

The ZyXEL Device automatically restarts in this time causing a temporary network disconnect. In some operating systems, you may see the following icon on your desktop.

Figure 167 Network Temporarily Disconnected

After two minutes, log in again and check your new firmware version in the **Status** screen.

If the upload was not successful, the following screen will appear. Click **Return** to go back to the **Firmware** screen.

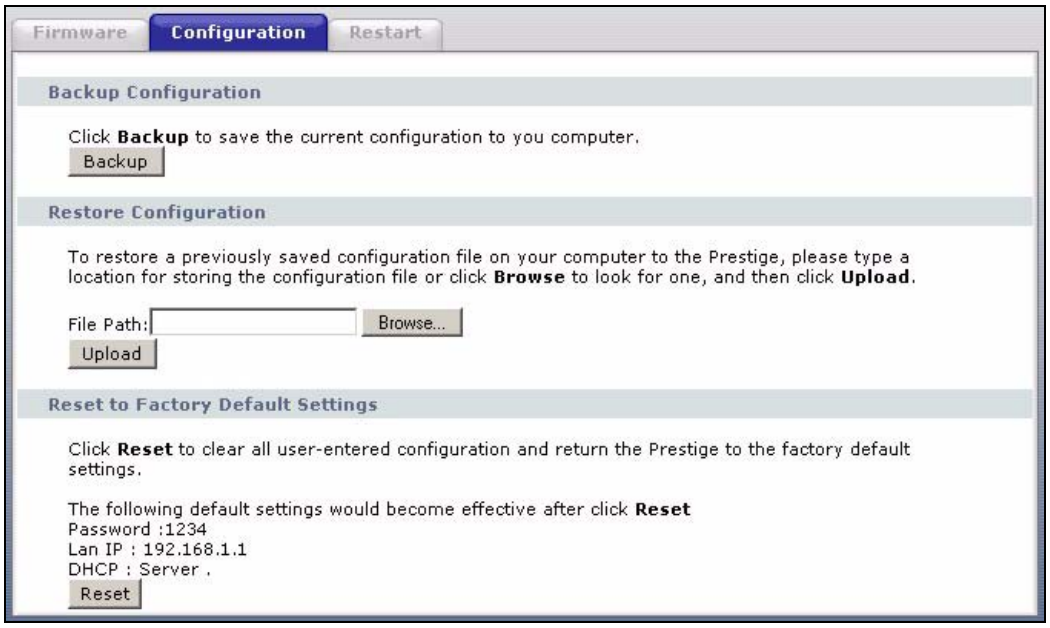
Figure 168 Error Message

System Upload
Firmware upload error!
The uploaded file was not accepted by the device. Please return to the previous page and select a valid upgrade file. Click Help for more information.
Return

21.2 Configuration Screen

Click **Maintenance > Tools** > **Configuration**. Information related to factory defaults, backup configuration, and restoring configuration appears as shown next.

Figure 169 Configuration


Firmware
Configuration
Restart
Backup Configuration
Click Backup to save the current configuration to you computer.
Backup
Restore Configuration
To restore a previously saved configuration file on your computer to the Prestige, please type a location for storing the configuration file or click Browse to look for one, and then click Upload.
File Path:
Browse...
Upload
Reset to Factory Default Settings
Click Reset to clear all user-entered configuration and return the Prestige to the factory default settings.
The following default settings would become effective after click Reset
Password :1234
Lan IP : 192.168.1.1
DHCP : Server .
Reset

21.2.1 Backup Configuration

Backup configuration allows you to back up (save) the ZyXEL Device's current configuration to a file on your computer. Once your ZyXEL Device is configured and functioning properly, it is highly recommended that you back up your configuration file before making configuration changes. The backup configuration file will be useful in case you need to return to your previous settings.

Click **Backup** to save the ZyXEL Device's current configuration to your computer

21.2.2 Restore Configuration

Restore configuration allows you to upload a new or previously saved configuration file from your computer to your ZyXEL Device.

Table 122 Maintenance Restore Configuration

LABEL	DESCRIPTION
File Path	Type in the location of the file you want to upload in this field or click **Browse...** to find it.
Browse...	Click **Browse...** to find the file you want to upload. Remember that you must decompress compressed (.ZIP) files before you can upload them.
Upload	Click **Upload** to begin the upload process.

Do not turn off the ZyXEL Device while configuration file upload is in progress

After you see a "Restore Configuration successful" screen, you must then wait one minute before logging into the ZyXEL Device again.

Figure 170 Configuration Restore Successful

ZyXEL
Restore Configuration successful
The Router Is Rebooting Now.
Please Wait ...
The router will now reboot.
As there will be no indication of when the process is complete, please wait for one minute before attempting to access the router again.

The ZyXEL Device automatically restarts in this time causing a temporary network disconnect. In some operating systems, you may see the following icon on your desktop.

Figure 171 Temporarily Disconnected

If you uploaded the default configuration file you may need to change the IP address of your computer to be in the same subnet as that of the default ZyXEL Device IP address (192.168.1.1). See the appendix for details on how to set up your computer's IP address.

If the upload was not successful, the following screen will appear. Click **Return** to go back to the **Configuration** screen.

Figure 172 Configuration Restore Error

System Restore
Restore configuration error!
The configuration file was not accepted by the device. Please return to the previous page and select a valid configuration file. Click Help for more information.
Return

21.2.3 Back to Factory Defaults

Pressing the **RESET** button in this section clears all user-entered configuration information and returns the ZyXEL Device to its factory defaults.

You can also press the **RESET** button on the rear panel to reset the factory defaults of your ZyXEL Device. Refer to the chapter about introducing the web configurator for more information on the **RESET** button.

21.3 Restart

System restart allows you to reboot the ZyXEL Device without turning the power off.

Click **Maintenance > Tools** > **Restart**. Click **Restart** to have the ZyXEL Device reboot. This does not affect the ZyXEL Device's configuration.

Figure 173 Restart Screen

Firmware
Configuration
Restart
System Reboot
Click Restart to have the device perform a software restart. The SYS(or PWR) LED blinks as the device restarts and then stays steady on if the restart is successful. Wait a minute before logging into the device again.
Restart

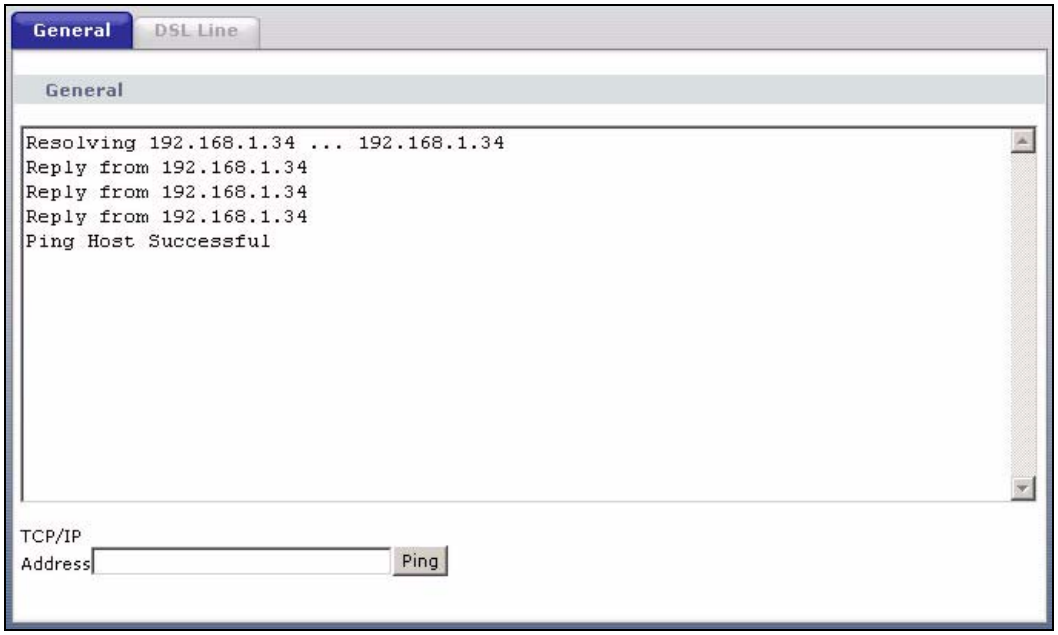
22 Diagnostic

These read-only screens display information to help you identify problems with the ZyXEL Device.

22.1 General Diagnostic

Click **Maintenance > Diagnostic** to open the screen shown next.

Figure 174 Diagnostic: General



The following table describes the fields in this screen.

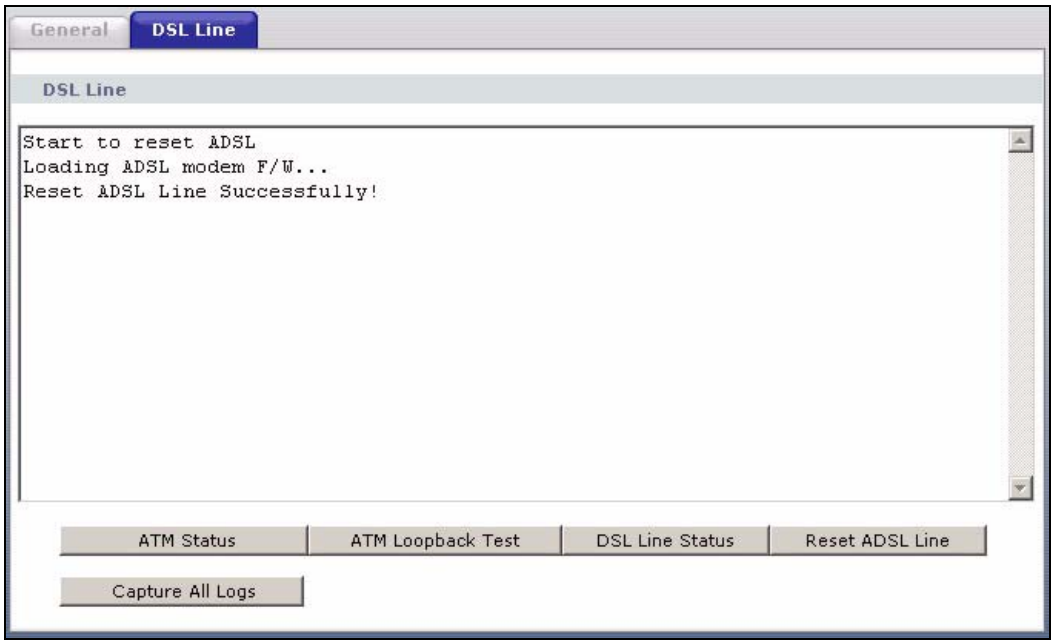
Table 123 Diagnostic: General

LABEL	DESCRIPTION
TCP/IP Address	Type the IP address of a computer that you want to ping in order to test a connection.
Ping	Click this button to ping the IP address that you entered.

22.2 DSL Line Diagnostic

Click **Maintenance > Diagnostic** > **DSL Line** to open the screen shown next.

Figure 175 Diagnostic: DSL Line



The following table describes the fields in this screen.

Table 124 Diagnostic: DSL Line

LABEL	DESCRIPTION
ATM Status	Click this button to view ATM status.
ATM Loopback Test	Click this button to start the ATM loopback test. Make sure you have configured at least one PVC with proper VPIs/VCIs before you begin this test. The ZyXEL Device sends an OAM F5 packet to the DSLAM/ATM switch and then returns it (loops it back) to the ZyXEL Device. The ATM loopback test is useful for troubleshooting problems with the DSLAM and ATM network.
DSL Line Status	Click this button to view the DSL port's line operating values and line bit allocation.
Reset ADSL Line	Click this button to reinitialize the ADSL line. The large text box above then displays the progress and results of this operation, for example: "Start to reset ADSL Loading ADSL modem F/W... Reset ADSL Line Successfully!"
Capture All Logs	Click this button to display all logs generated with the DSL line.

PART VII
Troubleshooting and Specifications

Troubleshooting (281)
Product Specifications (285)

23

Troubleshooting

This chapter offers some suggestions to solve problems you might encounter. The potential problems are divided into the following categories.

- Power, Hardware Connections, and LEDs
- ZyXEL Device Access and Login
- Internet Access
- Reset the ZyXEL Device to Its Factory Defaults

23.1 Power, Hardware Connections, and LEDs

The ZyXEL Device does not turn on. None of the LEDs turn on.

1. Make sure the ZyXEL Device is turned on.
2. Make sure you are using the power adaptor or cord included with the ZyXEL Device.
3. Make sure the power adaptor or cord is connected to the ZyXEL Device and plugged in to an appropriate power source. Make sure the power source is turned on.
4. Turn the ZyXEL Device off and on.
5. If the problem continues, contact the vendor.

One of the LEDs does not behave as expected.

1. Make sure you understand the normal behavior of the LED. See Section 23.1 on page 281.
2. Check the hardware connections. See the Quick Start Guide and Section 23.1 on page 281.
3. Inspect your cables for damage. Contact the vendor to replace any damaged cables.
4. Turn the ZyXEL Device off and on.
5. If the problem continues, contact the vendor.

23.2 ZyXEL Device Access and Login

I forgot the IP address for the ZyXEL Device.

1. The default IP address is **192.168.1.1**.
2. If you changed the IP address and have forgotten it, you might get the IP address of the ZyXEL Device by looking up the IP address of the default gateway for your computer. To do this in most Windows computers, click **Start > Run**, enter **cmd**, and then enter **ipconfig**. The IP address of the **Default Gateway** might be the IP address of the ZyXEL Device (it depends on the network), so enter this IP address in your Internet browser.
3. If this does not work, you have to reset the ZyXEL Device to its factory defaults. See Section 23.1 on page 281.

I forgot the password.

1. The default admin password is **1234**, and the default user password is **user**.
2. If this does not work, you have to reset the ZyXEL Device to its factory defaults. See Section 23.1 on page 281.

I cannot see or access the **Login** screen in the web configurator.

1. Make sure you are using the correct IP address.
   - The default IP address is 192.168.1.1.
   - If you changed the IP address (Section 23.1 on page 281), use the new IP address.
   - If you changed the IP address and have forgotten it, see the troubleshooting suggestions for I forgot the IP address for the ZyXEL Device.
2. Check the hardware connections, and make sure the LEDs are behaving as expected. See the Quick Start Guide and Section 23.1 on page 281.
3. Make sure your Internet browser does not block pop-up windows and has JavaScripts and Java enabled. See Section 23.1 on page 281.
4. If you disabled **Any IP** (Section 23.1 on page 281), make sure your computer is in the same subnet as the ZyXEL Device. (If you know that there are routers between your computer and the ZyXEL Device, skip this step.)
5. Reset the ZyXEL Device to its factory defaults, and try to access the ZyXEL Device with the default IP address. See Section 23.1 on page 281.
6. If the problem continues, contact the network administrator or vendor, or try one of the advanced suggestions.

I can see the **Login** screen, but I cannot log in to the ZyXEL Device.

1. Make sure you have entered the password correctly. The default user password is **user**, and the default admin password is **1234**. The field is case-sensitive, so make sure [Caps Lock] is not on.
2. Turn the ZyXEL Device off and on.
3. Disconnect and re-connect the power adaptor or cord to the ZyXEL Device.
4. If this does not work, you have to reset the ZyXEL Device to its factory defaults. See Section 23.1 on page 281.

I cannot use FTP to upload / download the configuration file. / I cannot use FTP to upload new firmware.

See the troubleshooting suggestions for I cannot see or access the Login screen in the web configurator. Ignore the suggestions about your browser.

23.3 Internet Access

I cannot access the Internet.

1. Check the hardware connections, and make sure the LEDs are behaving as expected. See the Quick Start Guide and Section 23.1 on page 281.
2. Make sure you entered your ISP account information correctly in the wizard. These fields are case-sensitive, so make sure [Caps Lock] is not on.
3. If you are trying to access the Internet wirelessly, make sure the wireless settings in the wireless client are the same as the settings in the AP.
4. Disconnect all the cables from your ZyXEL Device, and follow the directions in the Quick Start Guide again.
5. If the problem continues, contact your ISP.

I cannot access the Internet anymore. I had access to the Internet (with the ZyXEL Device), but my Internet connection is not available anymore.

1. Check the hardware connections, and make sure the LEDs are behaving as expected. See the Quick Start Guide and Section 23.1 on page 281.

2 Restart the ZyXEL Device.
3 If the problem continues, contact your ISP.

23.4 Reset the ZyXEL Device to Its Factory Defaults

If you reset the ZyXEL Device, you lose all of the changes you have made. The ZyXEL Device re-loads its default settings, and the password resets to **1234**. You have to make all of your changes again.

You will lose all of your changes when you push the **RESET** button.

To reset the ZyXEL Device,

1 Make sure the **POWER LED** is on and not blinking.
2 Press and hold the **RESET** button for five to ten seconds. Release the **RESET** button when the **POWER** LED begins to blink. The default settings have been restored.

If the ZyXEL Device restarts automatically, wait for the ZyXEL Device to finish restarting, and log in to the web configurator. The admin password is “1234”.

If the ZyXEL Device does not restart automatically, disconnect and reconnect the ZyXEL Device’s power. Then, follow the directions above again.

24

Product Specifications

This chapter gives details about your ZyXEL Device's hardware and firmware features.

24.1 General ZyXEL Device Specifications

The following tables summarize the ZyXEL Device's hardware and firmware features.

Table 125 Hardware Specifications

SPECIFICATION	DESCRIPTION
Dimensions (W x D x H)	180 x 128 x 36 mm
Power Specification	12V DC 1A
Built-in Switch	Four auto-negotiating, auto MDI/MDI-X 10/100 Mbps RJ-45 Ethernet ports
Operating Temperature	0º C ~ 40º C
Storage Temperature	-20º ~ 60º C
Operating Humidity	20% ~ 90% RH
Storage Humidity	20% ~ 90% RH
Distance separating the wall-mounting holes (centre to centre).	108 mm
Recommended screw size for wall-mounting	M4 Tap Screw, see Section 24.2.1 on page 289.

Table 126 Firmware Specifications

FEATURE	DESCRIPTION
Default IP Address	192.168.1.1
Default Subnet Mask	255.255.255.0 (24 bits)
Default Admin Password	1234
Default User Password	user
DHCP Pool	192.168.1.33 to 192.168.1.64
Device Management	Use the web configurator to easily configure the rich range of features on the ZyXEL Device.

Table 126 Firmware Specifications

FEATURE	DESCRIPTION
ADSL Standards	Multi-Mode standard (ANSI T1.413,Issue 2; G.dmt(G.992.1); G.lite(G992.2)). EOC in ITU-T (G992.2) ADSL2 G.dmt.bis (G.992.3) ADSL2 G.lite.bis (G.992.4) ADSL2+ (G.992.5) Extended-Reach ADSL (ER ADSL) SRA (Seamless Rate Adaptation) Auto-negotiating rate adaptation ADSL physical connection ATM AAL5 (ATM Adaptation Layer type 5) Multi-protocol over AAL5 (RFC2684/1483) PPP over ATM AAL5 (RFC 2364) PPP over Ethernet (RFC 2516) RFC 1483 encapsulation over ATM MAC encapsulated routing (ENET encapsulation) VC-based and LLC-based multiplexing Up to 8 PVCs (Permanent Virtual Circuits) I.610 F4/F5 OAM TR-067/TR-100
Other Protocol Support	PPP (Point-to-Point Protocol) link layer protocol. Transparent bridging for unsupported network layer protocols. DHCP Server/Client/Relay RIP I / RIP II ICMP ATM QoS SNMP v1 and v2c with MIB II support (RFC 1213) IP Multicasting IGMP v1 and v2 IGMP Proxy UPnP
Management	Embedded Web Configurator CLI (Command Line Interpreter) Remote Management via Telnet, FTP or Web SNMP manageable FTP/TFTP for firmware downloading, configuration backup and restoration. Syslog Built-in Diagnostic Tools for FLASH memory, ADSL circuitry, RAM and LAN port TR-069
Wireless	IEEE 802.11g compliance Frequency Range: 2.4 GHz Advanced Orthogonal Frequency Division Multiplexing (OFDM) Data Rates: 54Mbps and Auto Fallback Wired Equivalent Privacy (WEP) Data Encryption 64/128 bit WPA(2), WPA(2)-PSK Up to 32 MAC address filters WPS button

Table 126 Firmware Specifications

FEATURE	DESCRIPTION
Firewall	DoS Stateful Packet Inspection Protocol and generic filters Up to 20 Access Control List (ACL) rules between LAN and WAN Real-time E-mail alerts Reports and logs
NAT/SUA	Port Forwarding 2048 NAT sessions Multimedia applications PPTP under NAT/SUA SIP ALG passthrough VPN passthrough
Content Filtering	Web page blocking by URL keyword.
Static Routes	16 IP static routes
Other Features	Any IP Zero Configuration (VC auto-hunting) Traffic Redirect Dynamic DNS IP Alias MBM (Multimedia Bandwidth Management) QoS (Quality of Service)

The following list, which is not exhaustive, illustrates the standards supported in the ZyXEL Device.

Table 127 Standards Supported

STANDARD	DESCRIPTION
RFC 867	Daytime Protocol
RFC 868	Time Protocol.
RFC 1058	RIP-1 (Routing Information Protocol)
RFC 1112	IGMP v1
RFC 1157	SNMPv1: Simple Network Management Protocol version 1
RFC 1305	Network Time Protocol (NTP version 3)
RFC 1441	SNMPv2 Simple Network Management Protocol version 2
RFC 1483	Multiprotocol Encapsulation over ATM Adaptation Layer 5
RFC 1631	IP Network Address Translator (NAT)
RFC 1661	The Point-to-Point Protocol (PPP)
RFC 1723	RIP-2 (Routing Information Protocol)
RFC 1901	SNMPv2c Simple Network Management Protocol version 2c
RFC 2236	Internet Group Management Protocol, Version 2.
RFC 2364	PPP over AAL5 (PPP over ATM over ADSL)
RFC 2408	Internet Security Association and Key Management Protocol (ISAKMP)
RFC 2516	A Method for Transmitting PPP Over Ethernet (PPPoE)
RFC 2684	Multiprotocol Encapsulation over ATM Adaptation Layer 5.

Table 127 Standards Supported (continued)

STANDARD	DESCRIPTION
RFC 2766	Network Address Translation - Protocol
IEEE 802.11	Also known by the brand Wi-Fi, denotes a set of Wireless LAN/WLAN standards developed by working group 11 of the IEEE LAN/MAN Standards Committee (IEEE 802).
IEEE 802.11b	Uses the 2.4 gigahertz (GHz) band
IEEE 802.11g	Uses the 2.4 gigahertz (GHz) band
IEEE 802.11g+	Turbo and Super G modes
IEEE 802.11d	Standard for Local and Metropolitan Area Networks: Media Access Control (MAC) Bridges
IEEE 802.11x	Port Based Network Access Control.
IEEE 802.11e QoS	IEEE 802.11 e Wireless LAN for Quality of Service
ANSI T1.413, Issue 2	Asymmetric Digital Subscriber Line (ADSL) standard.
G dmt(G.992.1)	G.992.1 Asymmetrical Digital Subscriber Line (ADSL) Transceivers
ITU G.992.1 (G.DMT)	ITU standard for ADSL using discrete multitone modulation.
ITU G.992.2 (G. Lite)	ITU standard for ADSL using discrete multitone modulation.
ITU G.992.3 (G.dmt.bis)	ITU standard (also referred to as ADSL2) that extends the capability of basic ADSL in data rates.
ITU G.992.4 (G.lite.bis)	ITU standard (also referred to as ADSL2) that extends the capability of basic ADSL in data rates.
ITU G.992.5 (ADSL2+)	ITU standard (also referred to as ADSL2+) that extends the capability of basic ADSL by doubling the number of downstream bits.
ITU-T G.993.1 (VDSL)	ITU standard that defines VDSL.
ITU-T G.993.2 (VDSL2)	ITU standard that defines VDSL2.
Microsoft PPTP	MS PPTP (Microsoft's implementation of Point to Point Tunneling Protocol)
MBM v2	Media Bandwidth Management v2
RFC 2383	ST2+ over ATM Protocol Specification - UNI 3.1 Version
TR-069	TR-069 DSL Forum Standard for CPE Wan Management.
1.363.5	Compliant AAL5 SAR (Segmentation And Re-assembly)

24.2 Wall-mounting Instructions

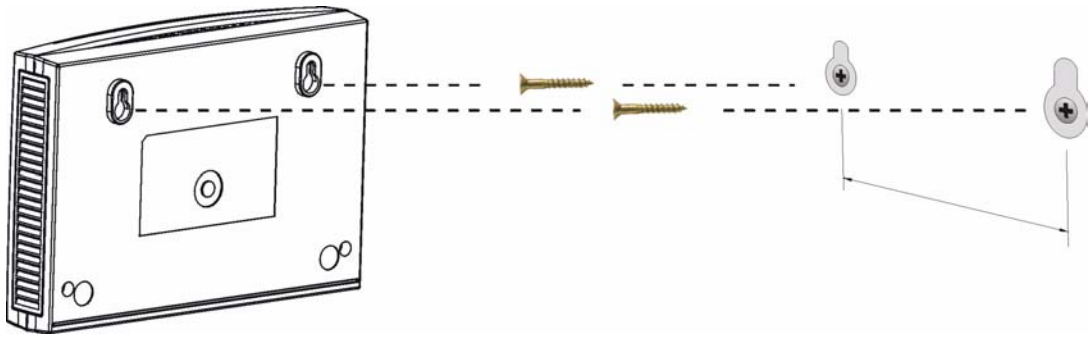
Complete the following steps to hang your ZyXEL Device on a wall.

1. Select a position free of obstructions on a sturdy wall.
2. Drill two holes for the screws.

Be careful to avoid damaging pipes or cables located inside the wall when drilling holes for the screws.

3 Do not insert the screws all the way into the wall. Leave a small gap of about 0.5 cm between the heads of the screws and the wall.
4 Make sure the screws are snugly fastened to the wall. They need to hold the weight of the ZyXEL Device with the connection cables.
5 Align the holes on the back of the ZyXEL Device with the screws on the wall. Hang the ZyXEL Device on the screws.

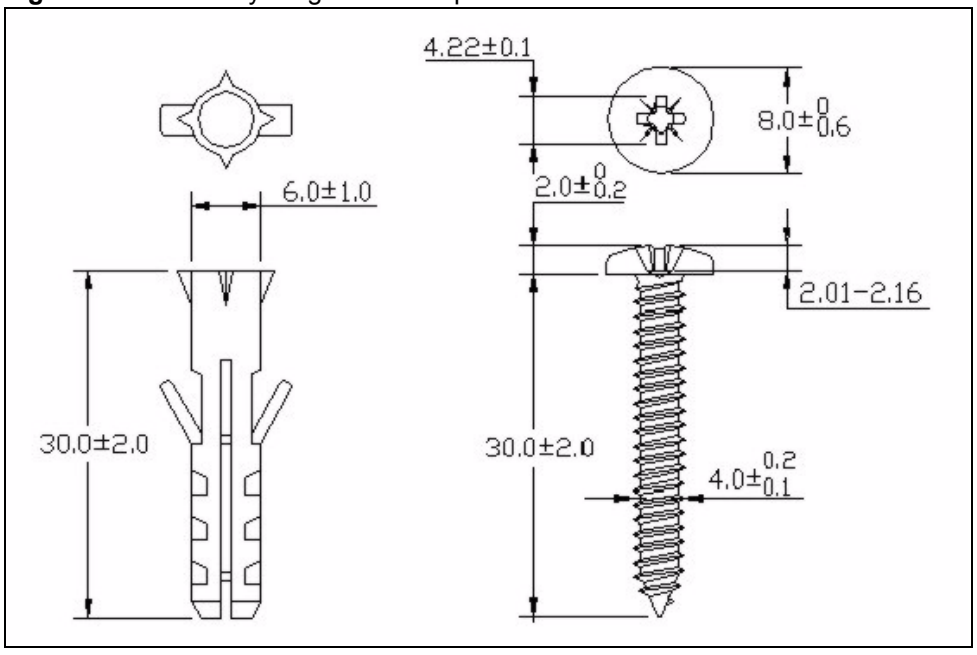
Figure 176 Wall-mounting Example



24.2.1 M4 Tap Screw and Masonry Plug

The following are dimensions of an M4 tap screw and masonry plug used for wall mounting. All measurements are in millimeters (mm).

Figure 177 Masonry Plug and M4 Tap Screw



PART VIII Appendices and Index

The appendices provide general information. Some details may not apply to your ZyXEL Device.

Setting Up Your Computer's IP Address (293)

Pop-up Windows, JavaScripts and Java Permissions (317)

IP Addresses and Subnetting (325)

Wireless LANs (335)

NetBIOS Filter Commands (355)

Internal SPTGEN (357)

Legal Information (373)

Customer Support (377)

Index (383)

A

Setting Up Your Computer's IP Address

Your specific ZyXEL device may not support all of the operating systems described in this appendix. See the product specifications for more information about which operating systems are supported.

This appendix shows you how to configure the IP settings on your computer in order for it to be able to communicate with the other devices on your network. Windows Vista/XP/2000, Mac OS 9/OS X, and all versions of UNIX/LINUX include the software components you need to use TCP/IP on your computer.

If you manually assign IP information instead of using a dynamic IP, make sure that your network's computers have IP addresses that place them in the same subnet.

In this appendix, you can set up an IP address for:

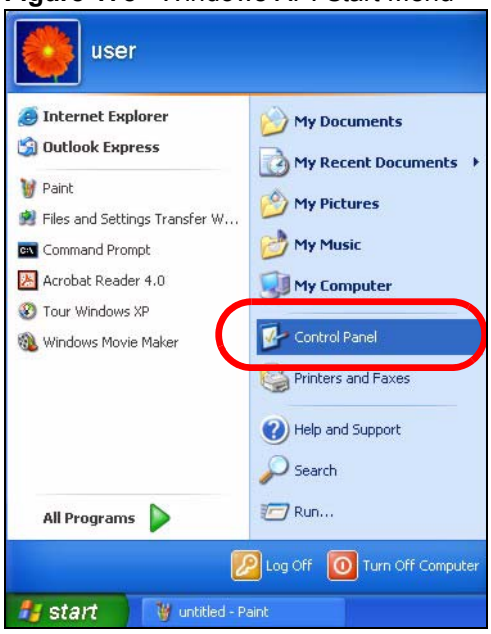
- Windows XP/NT/2000 on page 293
- Windows Vista on page 296
- Mac OS X: 10.3 and 10.4 on page 300
- Mac OS X: 10.5 on page 304
- Linux: Ubuntu 8 (GNOME) on page 307
- Linux: openSUSE 10.3 (KDE) on page 310

Windows XP/NT/2000

The following example uses the default Windows XP display theme but can also apply to Windows 2000 and Windows NT.

1 Click **Start** > **Control Panel**.

Figure 178 Windows XP: Start Menu

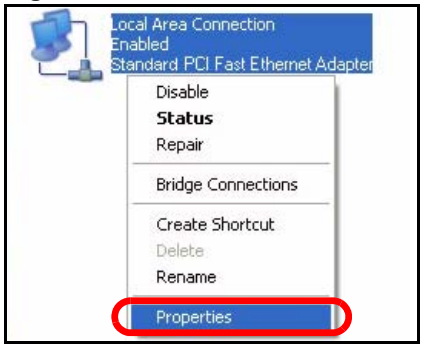


2 In the **Control Panel**, click the **Network Connections** icon.

Figure 179 Windows XP: Control Panel

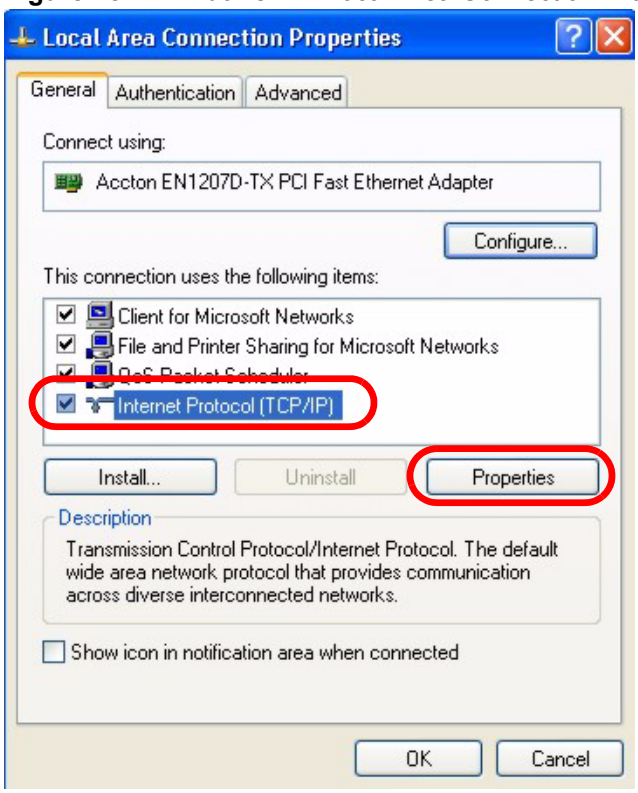
3 Right-click **Local Area Connection** and then select **Properties**.

Figure 180 Windows XP: Control Panel > Network Connections > Properties



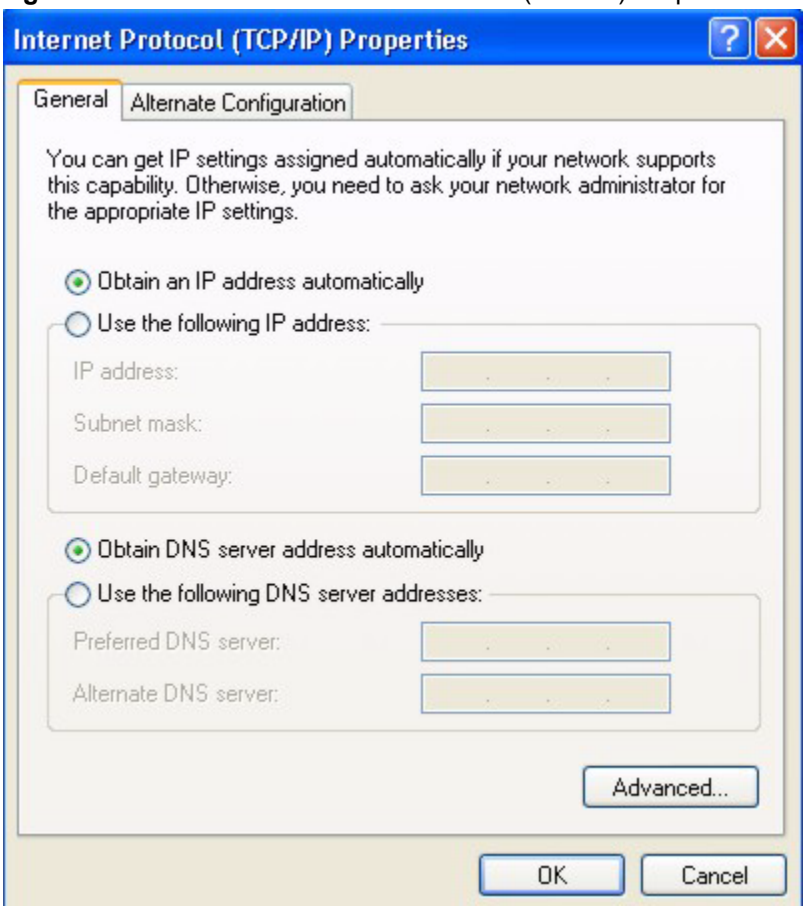
4 On the **General** tab, select **Internet Protocol (TCP/IP)** and then click **Properties**.

Figure 181 Windows XP: Local Area Connection Properties



5 The **Internet Protocol TCP/IP Properties** window opens.

Figure 182 Windows XP: Internet Protocol (TCP/IP) Properties


Internet Protocol (TCP/IP) Properties
General
Alternate Configuration
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
Subnet mask:
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

6 Select **Obtain an IP address automatically** if your network administrator or ISP assigns your IP address dynamically.

Select **Use the following IP Address** and fill in the **IP address**, **Subnet mask**, and **Default gateway** fields if you have a static IP address that was assigned to you by your network administrator or ISP. You may also have to enter a **Preferred DNS server** and an **Alternate DNS server,** if that information was provided.

7 Click **OK** to close the **Internet Protocol (TCP/IP) Properties** window.

8 Click **OK** to close the **Local Area Connection Properties** window.

Verifying Settings

1 Click **Start** > **All Programs** > **Accessories** > **Command Prompt**.

2 In the **Command Prompt** window, type "ipconfig" and then press [ENTER].

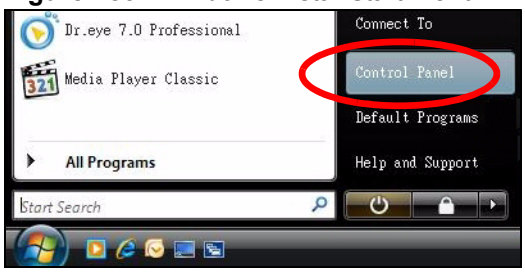
You can also go to **Start > Control Panel > Network Connections**, right-click a network connection, click **Status** and then click the **Support** tab to view your IP address and connection information.

Windows Vista

This section shows screens from Windows Vista Professional.

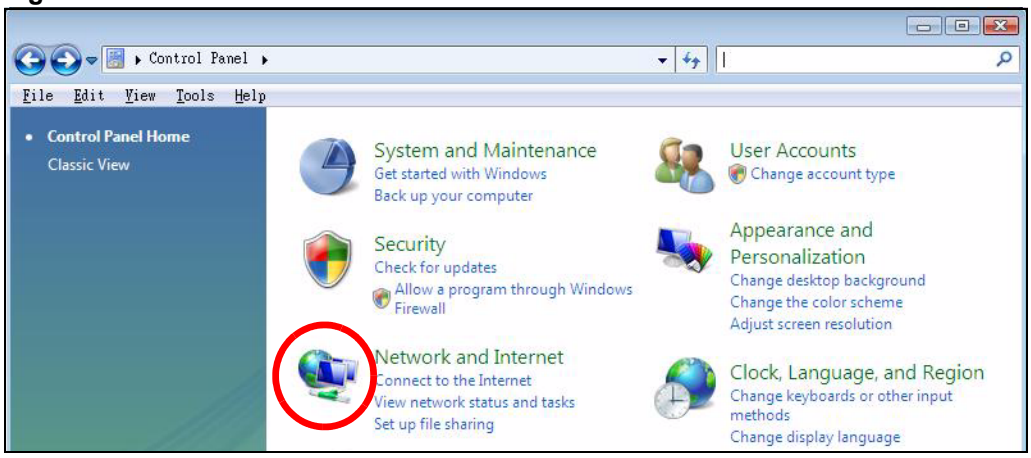
1 Click **Start** > **Control Panel**.

Figure 183 Windows Vista: Start Menu



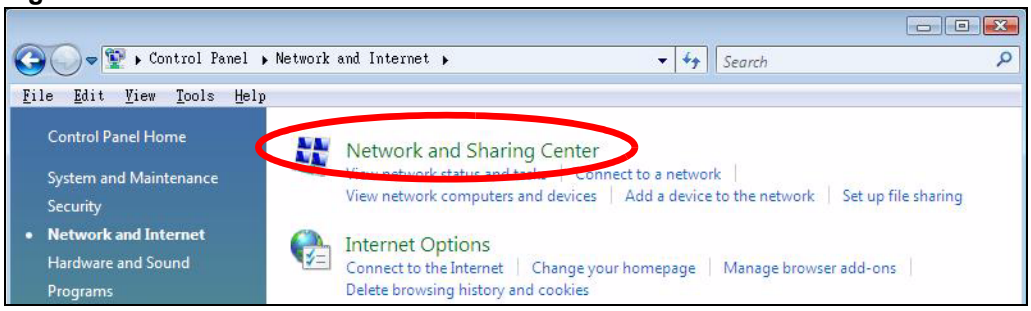
2 In the **Control Panel**, click the **Network and Internet** icon.

Figure 184 Windows Vista: Control Panel



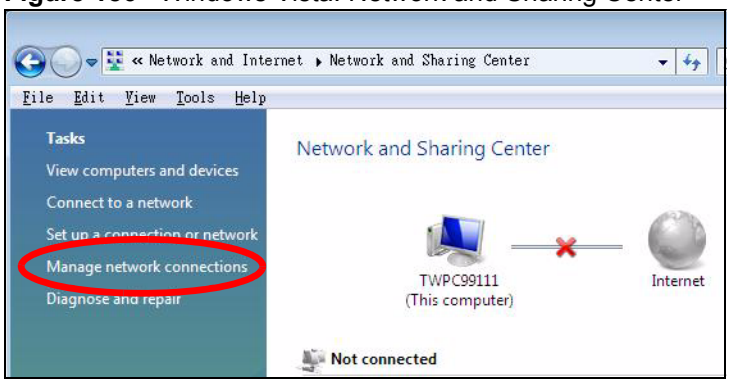
3 Click the **Network and Sharing Center** icon.

Figure 185 Windows Vista: Network And Internet



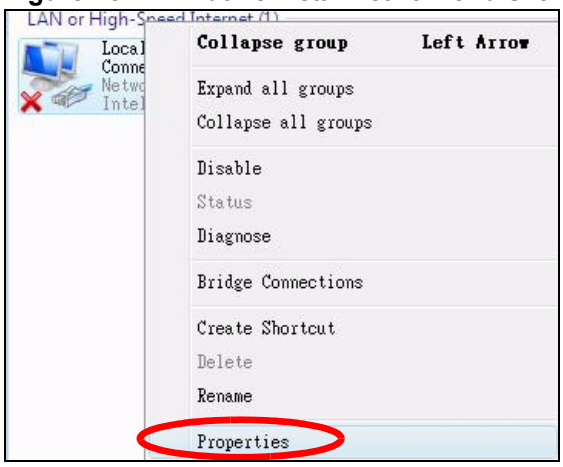
4 Click **Manage network connections**.

Figure 186 Windows Vista: Network and Sharing Center



5 Right-click **Local Area Connection** and then select **Properties**.

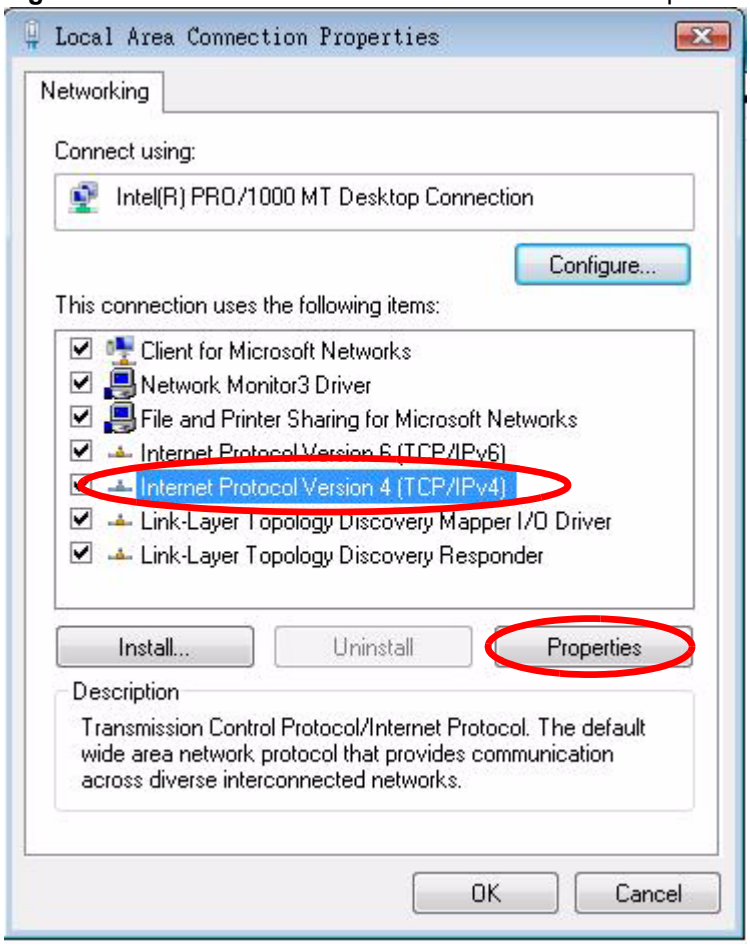
Figure 187 Windows Vista: Network and Sharing Center



During this procedure, click **Continue** whenever Windows displays a screen saying that it needs your permission to continue.

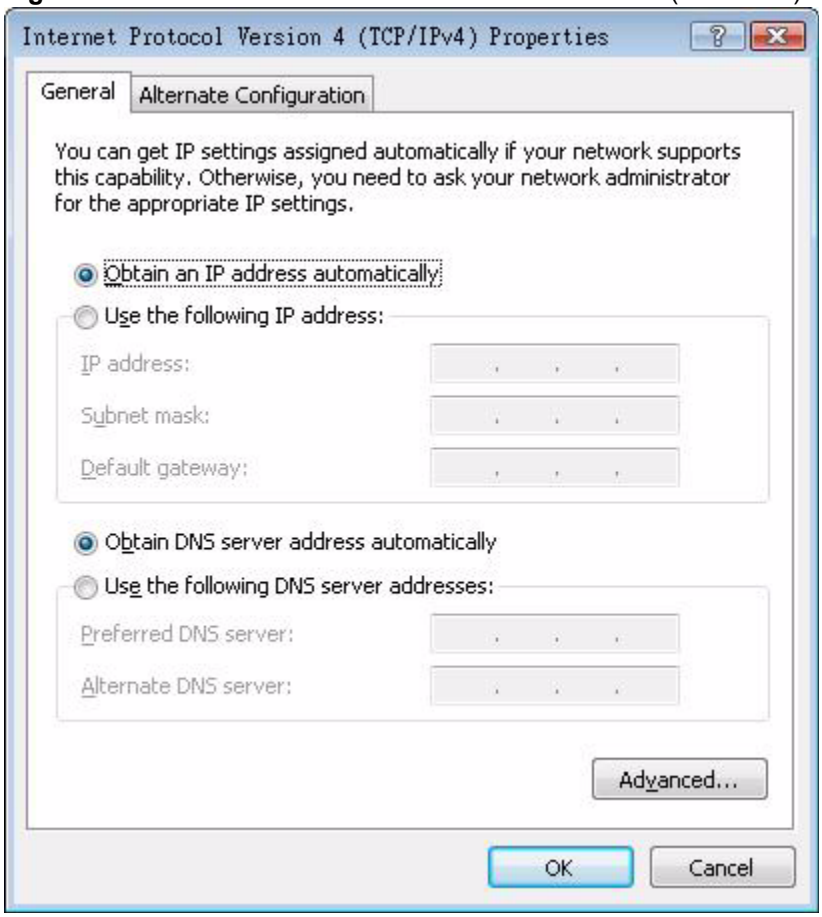
6 Select **Internet Protocol Version 4 (TCP/IPv4)** and then select **Properties**.

Figure 188 Windows Vista: Local Area Connection Properties



7 The **Internet Protocol Version 4 (TCP/IPv4) Properties** window opens.

Figure 189 Windows Vista: Internet Protocol Version 4 (TCP/IPv4) Properties


Internet Protocol Version 4 (TCP/IPv4) Properties
General
Alternate Configuration
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
Subnet mask:
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

8 Select **Obtain an IP address automatically** if your network administrator or ISP assigns your IP address dynamically.

Select **Use the following IP Address** and fill in the **IP address**, **Subnet mask**, and **Default gateway** fields if you have a static IP address that was assigned to you by your network administrator or ISP. You may also have to enter a **Preferred DNS server** and an **Alternate DNS server,** if that information was provided.Click **Advanced**.

9 Click **OK** to close the **Internet Protocol (TCP/IP) Properties** window.

10 Click **OK** to close the **Local Area Connection Properties** window.

Verifying Settings

1 Click **Start** > **All Programs** > **Accessories** > **Command Prompt**.

2 In the **Command Prompt** window, type "ipconfig" and then press [ENTER].

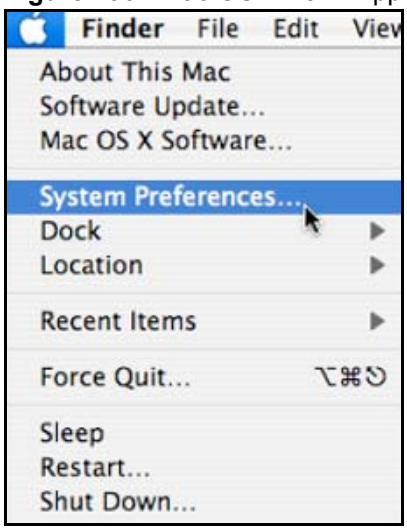
You can also go to **Start > Control Panel > Network Connections**, right-click a network connection, click **Status** and then click the **Support** tab to view your IP address and connection information.

Mac OS X: 10.3 and 10.4

The screens in this section are from Mac OS X 10.4 but can also apply to 10.3.

1 Click **Apple** > **System Preferences**.

Figure 190 Mac OS X 10.4: Apple Menu

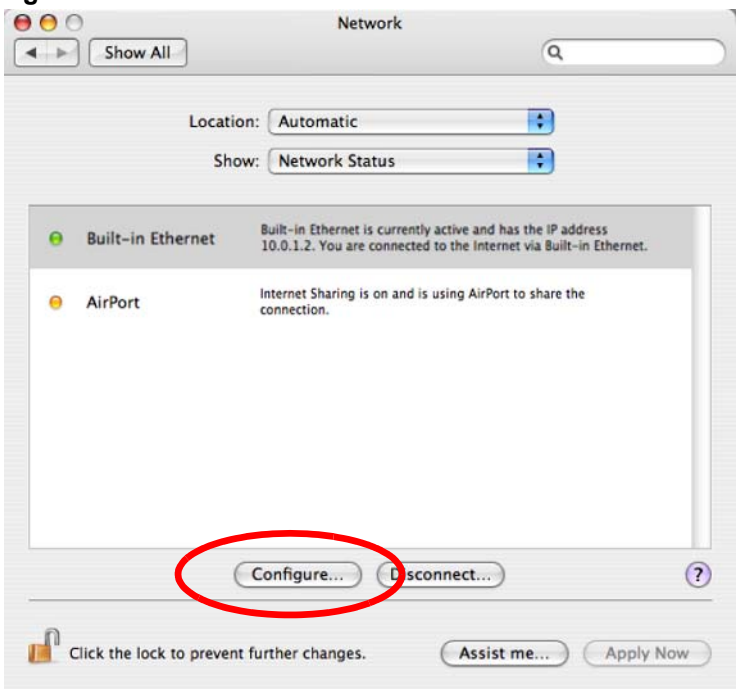


2 In the **System Preferences** window, click the **Network** icon.

Figure 191 Mac OS X 10.4: System Preferences

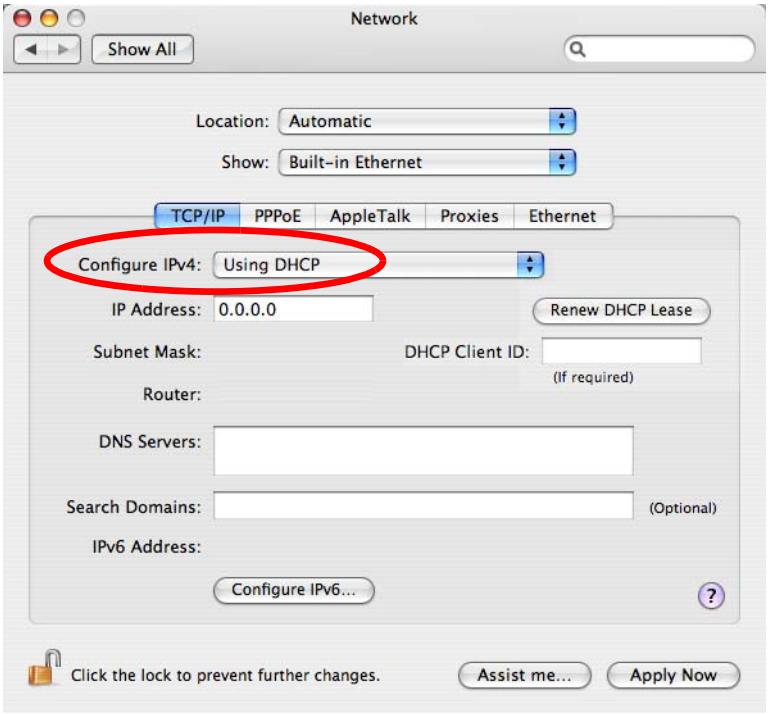
3 When the **Network** preferences pane opens, select **Built-in Ethernet** from the network connection type list, and then click **Configure.**

Figure 192 Mac OS X 10.4: Network Preferences


Network
Show All
Location: Automatic
Show: Network Status
Built-in Ethernet
Built-in Ethernet is currently active and has the IP address 10.0.1.2. You are connected to the Internet via Built-in Ethernet.
AirPort
Internet Sharing is on and is using AirPort to share the connection.
Configure...
Disconnect...
Click the lock to prevent further changes.
Assist me...
Apply Now

4 For dynamically assigned settings, select **Using DHCP** from the **Configure IPv4** list in the **TCP/IP** tab.

Figure 193 Mac OS X 10.4: Network Preferences > TCP/IP Tab.

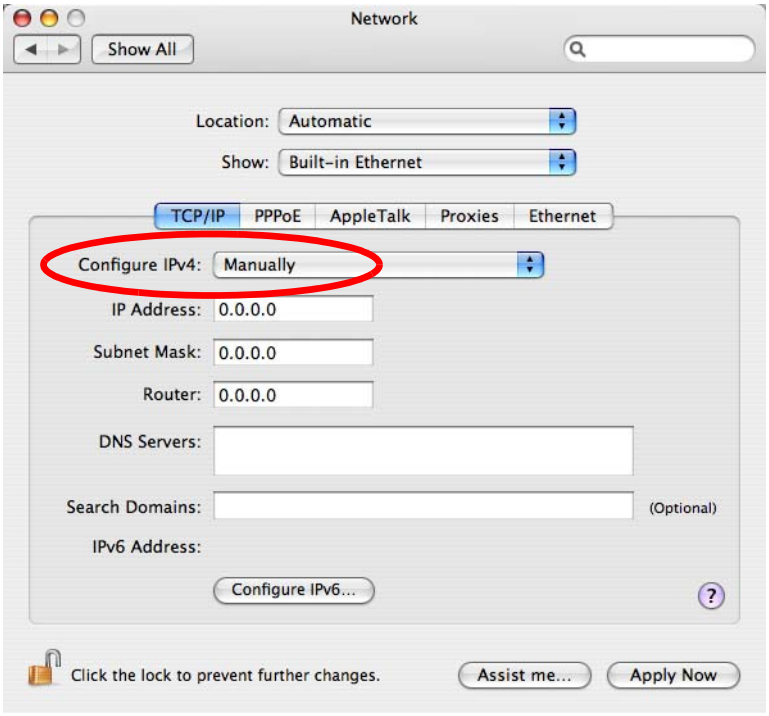


5 For statically assigned settings, do the following:

- From the **Configure IPv4** list, select **Manually**.
- In the **IP Address** field, type your IP address.

- In the **Subnet Mask** field, type your subnet mask.
- In the **Router** field, type the IP address of your device.

Figure 194 Mac OS X 10.4: Network Preferences > Ethernet

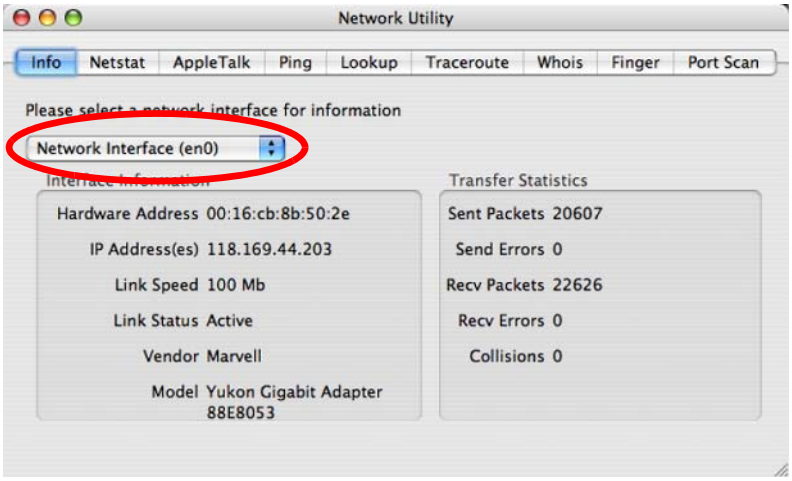


6 Click **Apply Now** and close the window.

Verifying Settings

Check your TCP/IP properties by clicking **Applications > Utilities > Network Utilities**, and then selecting the appropriate **Network Interface** from the **Info** tab.

Figure 195 Mac OS X 10.4: Network Utility

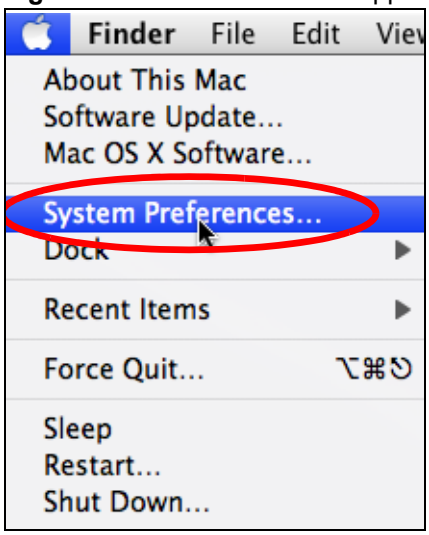


Mac OS X: 10.5

The screens in this section are from Mac OS X 10.5.

1 Click **Apple** > **System Preferences**.

Figure 196 Mac OS X 10.5: Apple Menu

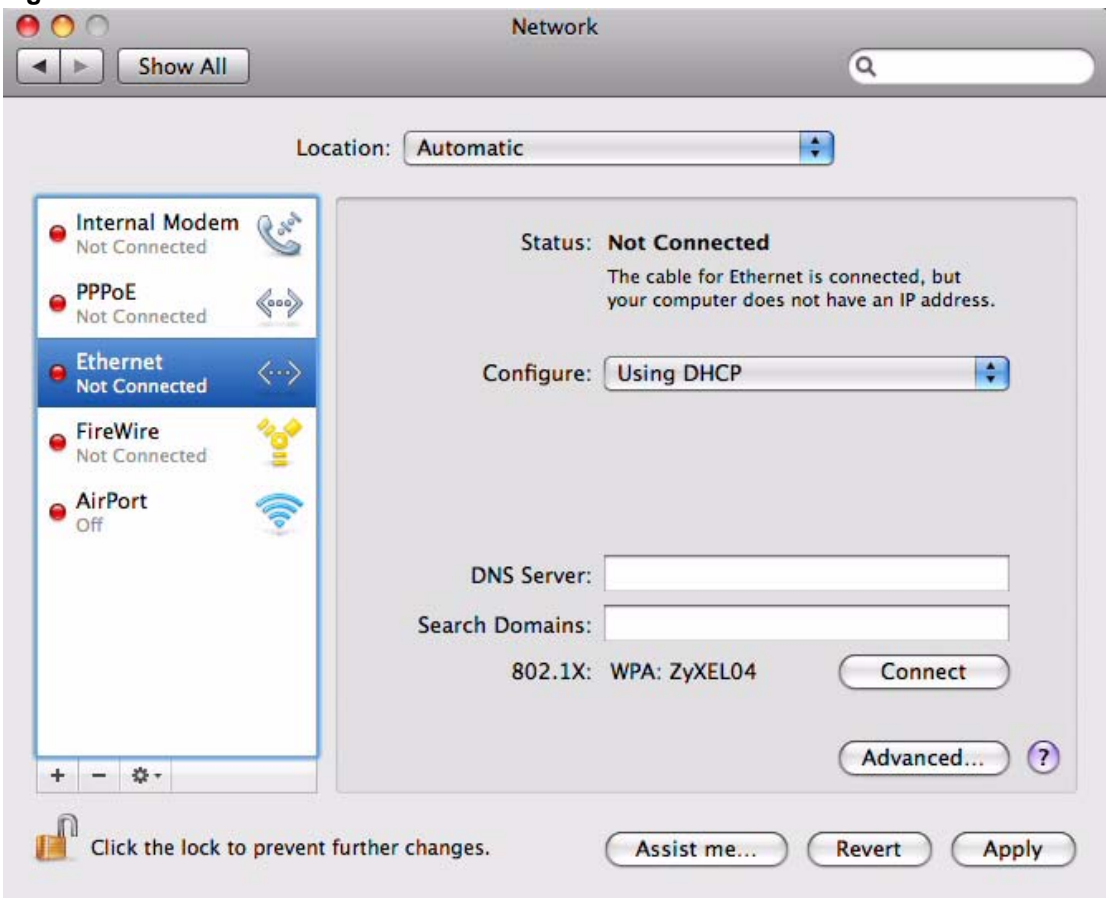


2 In **System Preferences**, click the **Network** icon.

Figure 197 Mac OS X 10.5: Systems Preferences

3 When the **Network** preferences pane opens, select **Ethernet** from the list of available connection types.

Figure 198 Mac OS X 10.5: Network Preferences > Ethernet

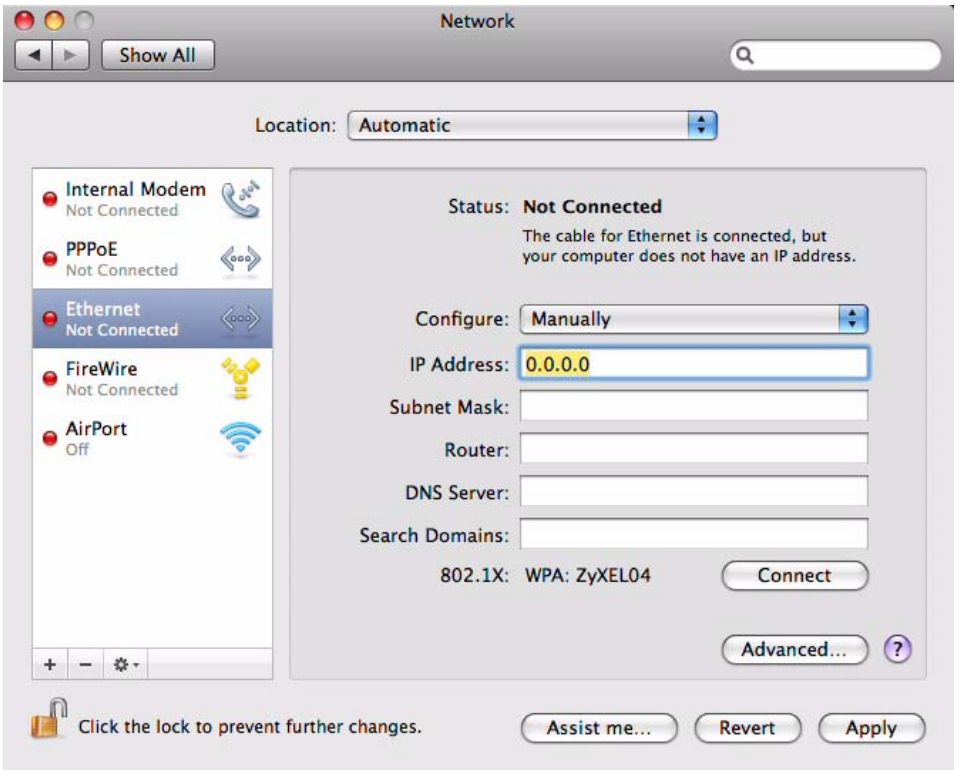


4 From the **Configure** list, select **Using DHCP** for dynamically assigned settings.

5 For statically assigned settings, do the following:

- From the **Configure** list, select **Manually**.
- In the **IP Address** field, enter your IP address.
- In the **Subnet Mask** field, enter your subnet mask.
- In the **Router** field, enter the IP address of your ZyXEL Device.

Figure 199 Mac OS X 10.5: Network Preferences > Ethernet

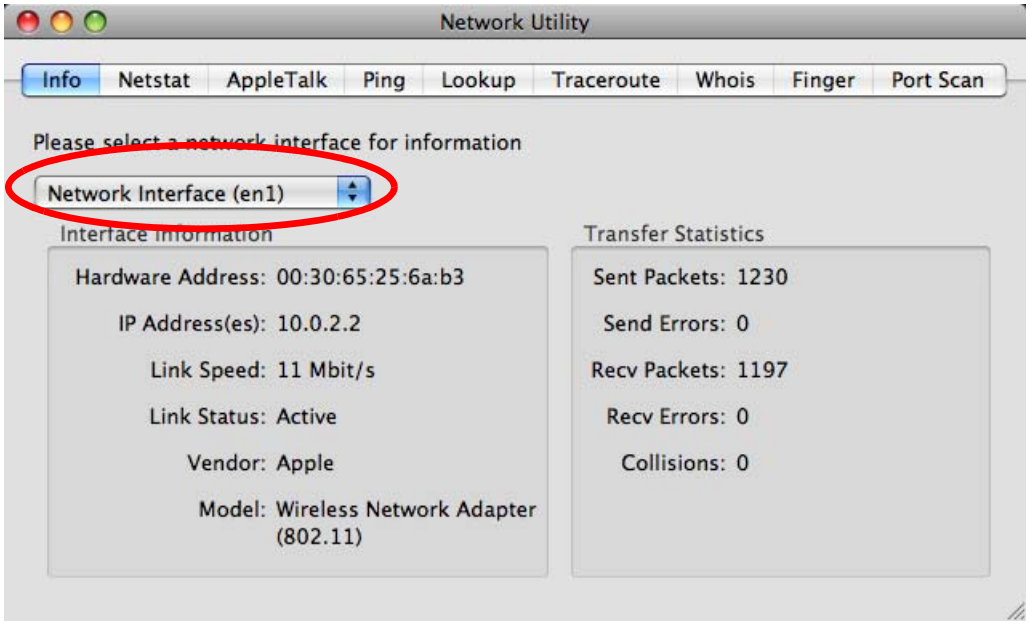


6 Click **Apply** and close the window.

Verifying Settings

Check your TCP/IP properties by clicking **Applications > Utilities > Network Utilities**, and then selecting the appropriate **Network interface** from the **Info** tab.

Figure 200 Mac OS X 10.5: Network Utility



Linux: Ubuntu 8 (GNOME)

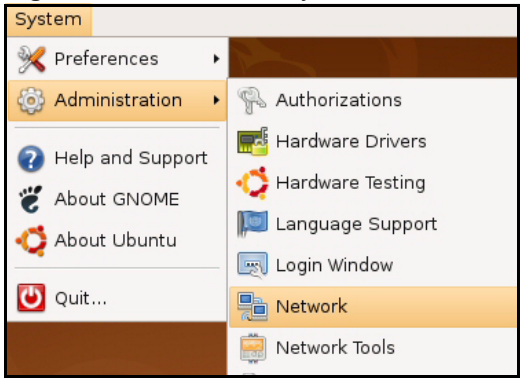
This section shows you how to configure your computer's TCP/IP settings in the GNU Object Model Environment (GNOME) using the Ubuntu 8 Linux distribution. The procedure, screens and file locations may vary depending on your specific distribution, release version, and individual configuration. The following screens use the default Ubuntu 8 installation.

Make sure you are logged in as the root administrator.

Follow the steps below to configure your computer IP address in GNOME:

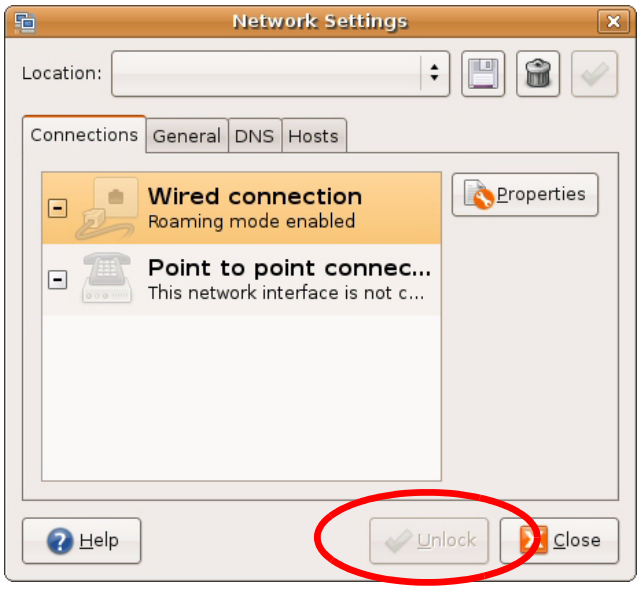
1 Click **System > Administration > Network**.

Figure 201 Ubuntu 8: System > Administration Menu



2 When the **Network Settings** window opens, click **Unlock** to open the **Authenticate** window. (By default, the **Unlock** button is greyed out until clicked.) You cannot make changes to your configuration unless you first enter your admin password.

Figure 202 Ubuntu 8: Network Settings > Connections



3 In the **Authenticate** window, enter your admin account name and password then click the **Authenticate** button.

Figure 203 Ubuntu 8: Administrator Account Authentication

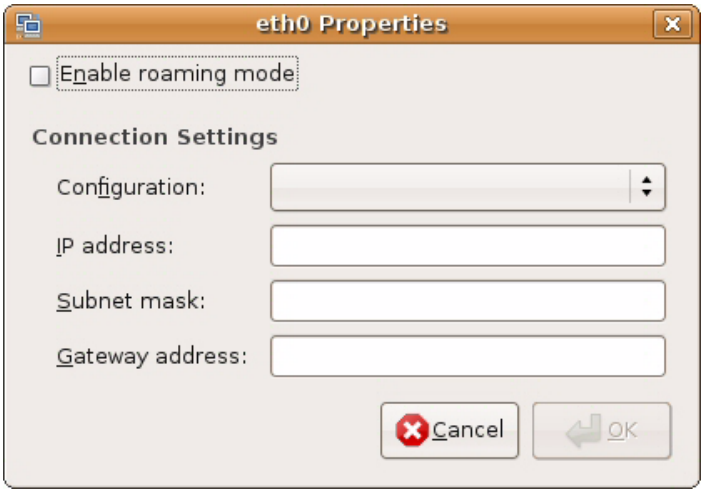
Authenticate
System policy prevents modifying the configuration
An application is attempting to perform an action that requires privileges. Authentication as one of the users below is required to perform this action.
C.J.,,,, (chris)
Password for chris:
Details
Cancel
Authenticate

4 In the **Network Settings** window, select the connection that you want to configure, then click **Properties**.

Figure 204 Ubuntu 8: Network Settings > Connections

5 The **Properties** dialog box opens.

Figure 205 Ubuntu 8: Network Settings > Properties

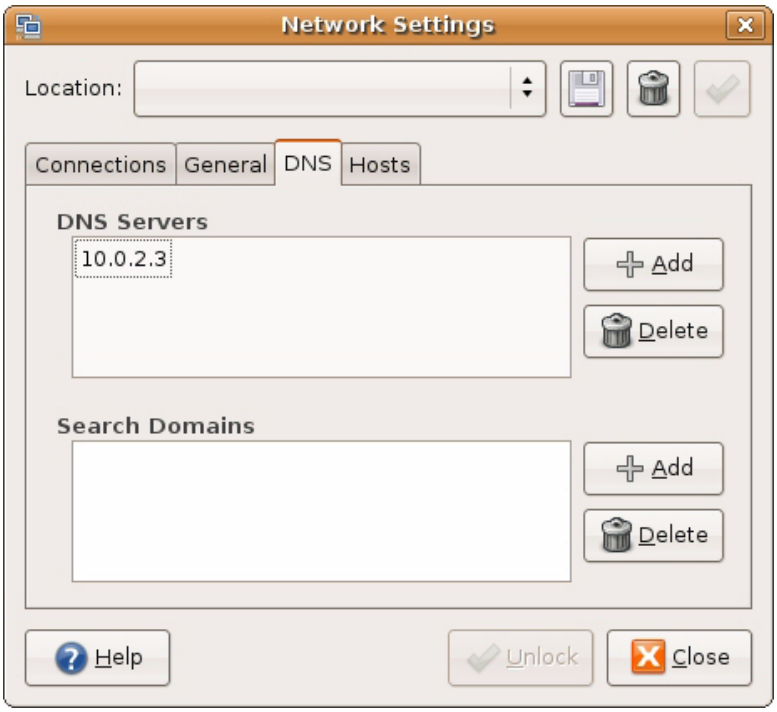


- In the **Configuration** list, select **Automatic Configuration (DHCP)** if you have a dynamic IP address.
- In the **Configuration** list, select **Static IP address** if you have a static IP address. Fill in the **IP address**, **Subnet mask**, and **Gateway address** fields.

6 Click **OK** to save the changes and close the **Properties** dialog box and return to the **Network Settings** screen.

7 If you know your DNS server IP address(es), click the **DNS** tab in the **Network Settings** window and then enter the DNS server information in the fields provided.

Figure 206 Ubuntu 8: Network Settings > DNS

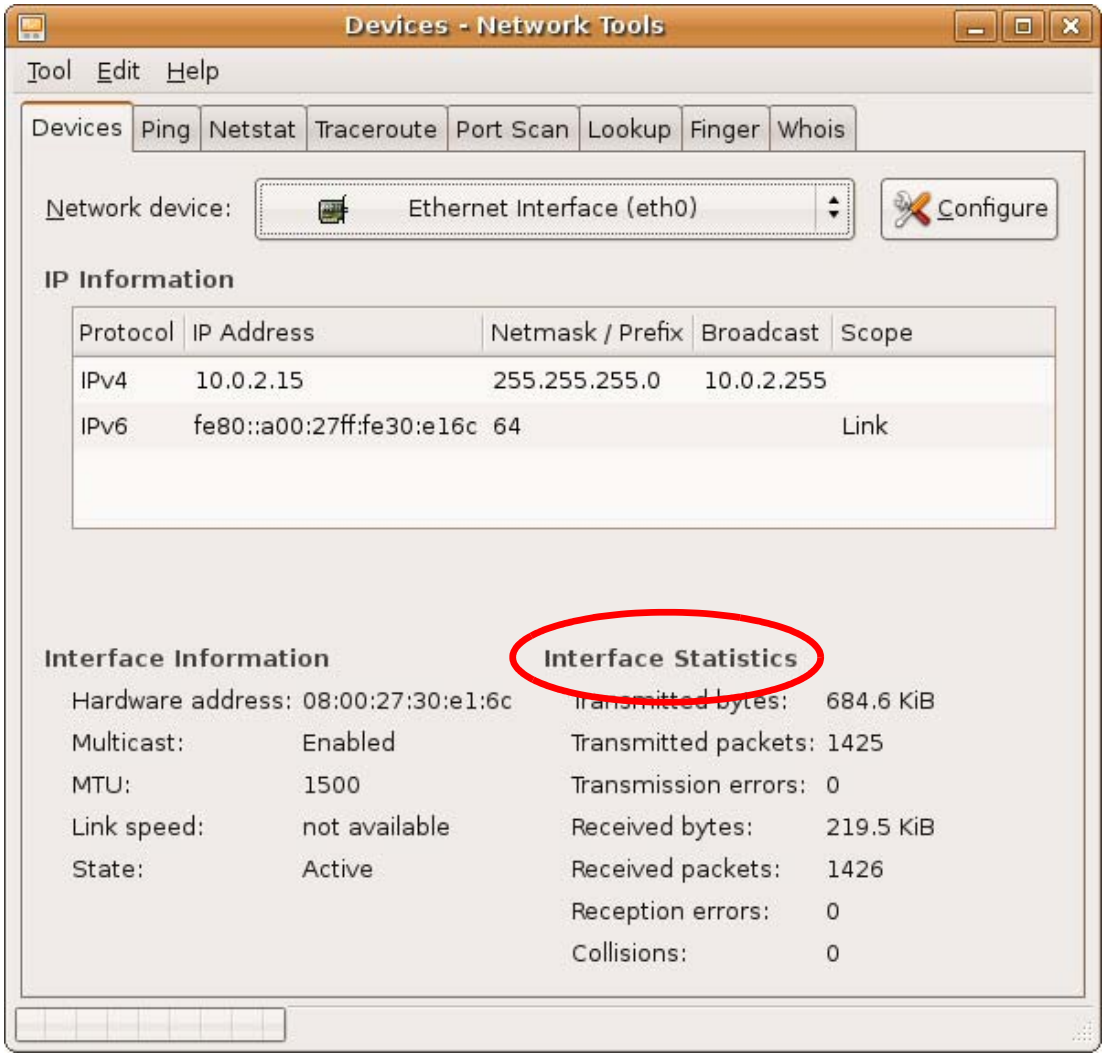


8 Click the **Close** button to apply the changes.

Verifying Settings

Check your TCP/IP properties by clicking **System > Administration > Network Tools**, and then selecting the appropriate **Network device** from the **Devices** tab. The **Interface Statistics** column shows data if your connection is working properly.

Figure 207 Ubuntu 8: Network Tools



Linux: openSUSE 10.3 (KDE)

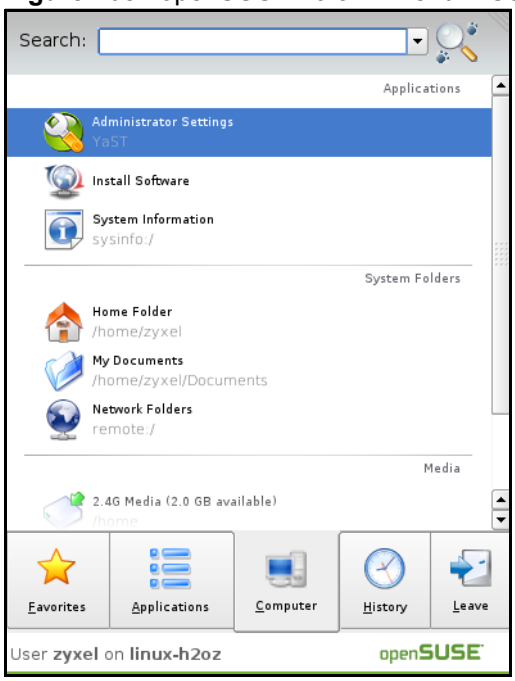
This section shows you how to configure your computer's TCP/IP settings in the K Desktop Environment (KDE) using the openSUSE 10.3 Linux distribution. The procedure, screens and file locations may vary depending on your specific distribution, release version, and individual configuration. The following screens use the default openSUSE 10.3 installation.

Make sure you are logged in as the root administrator.

Follow the steps below to configure your computer IP address in the KDE:

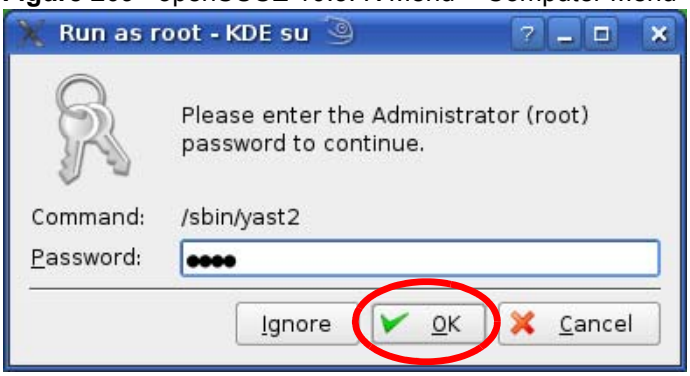
1 Click **K Menu > Computer > Administrator Settings (YaST)**.

Figure 208 openSUSE 10.3: K Menu > Computer Menu



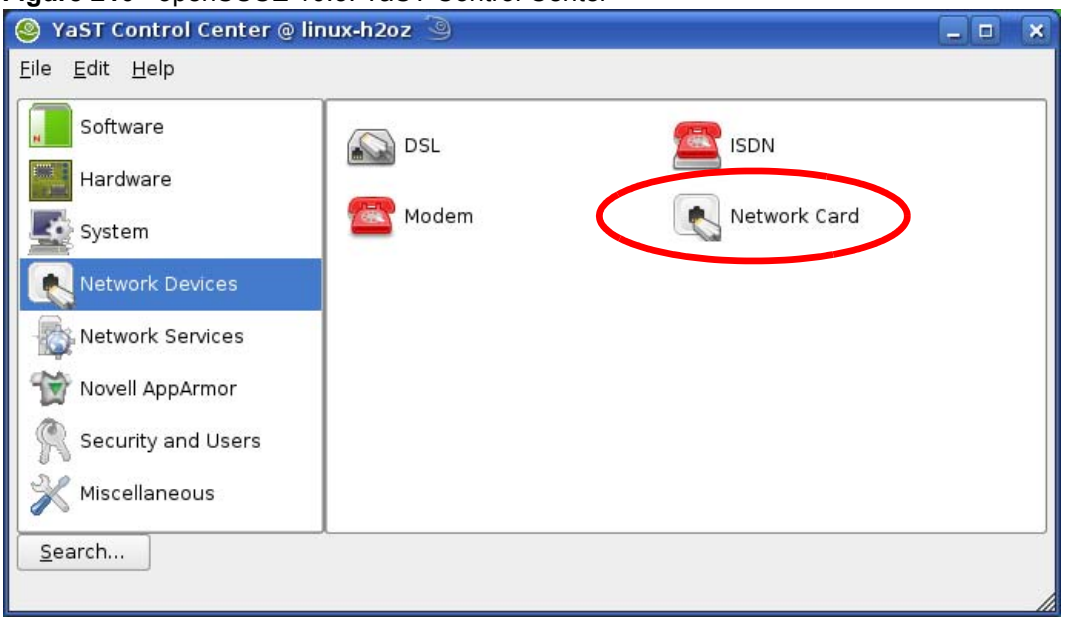
2 When the **Run as Root - KDE su** dialog opens, enter the admin password and click **OK**.

Figure 209 openSUSE 10.3: K Menu > Computer Menu



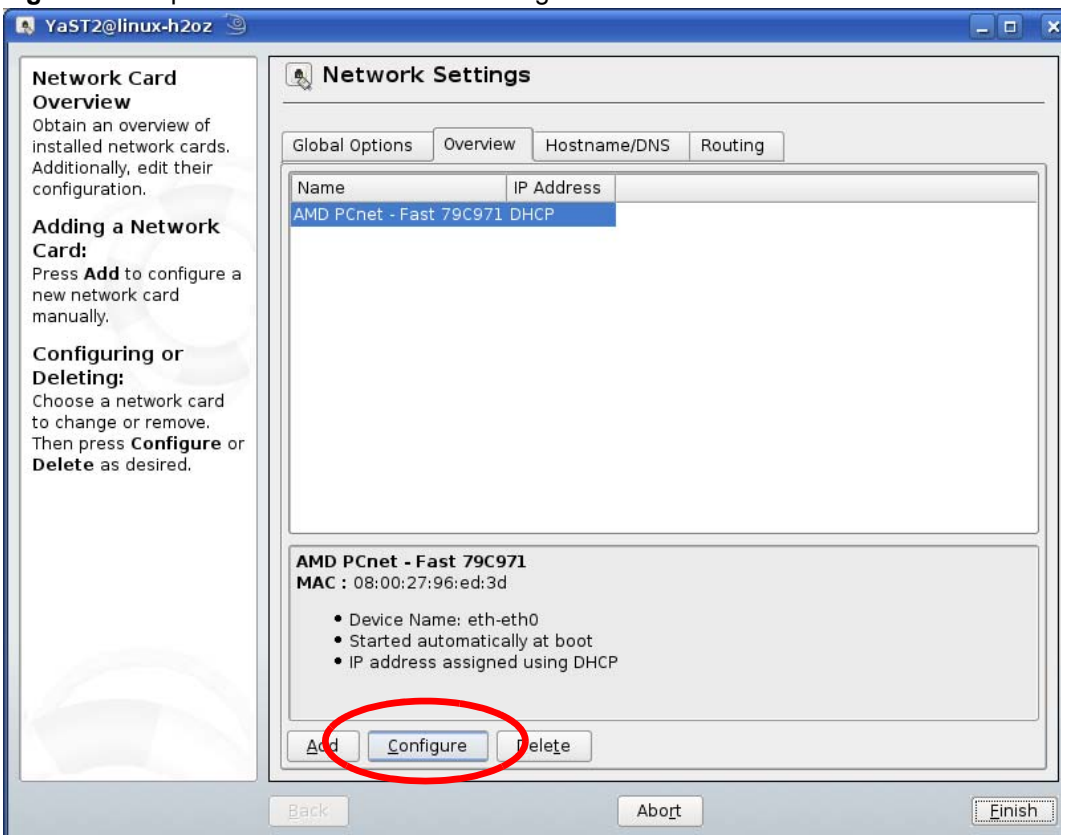
3 When the **YaST Control Center** window opens, select **Network Devices** and then click the **Network Card** icon.

Figure 210 openSUSE 10.3: YaST Control Center



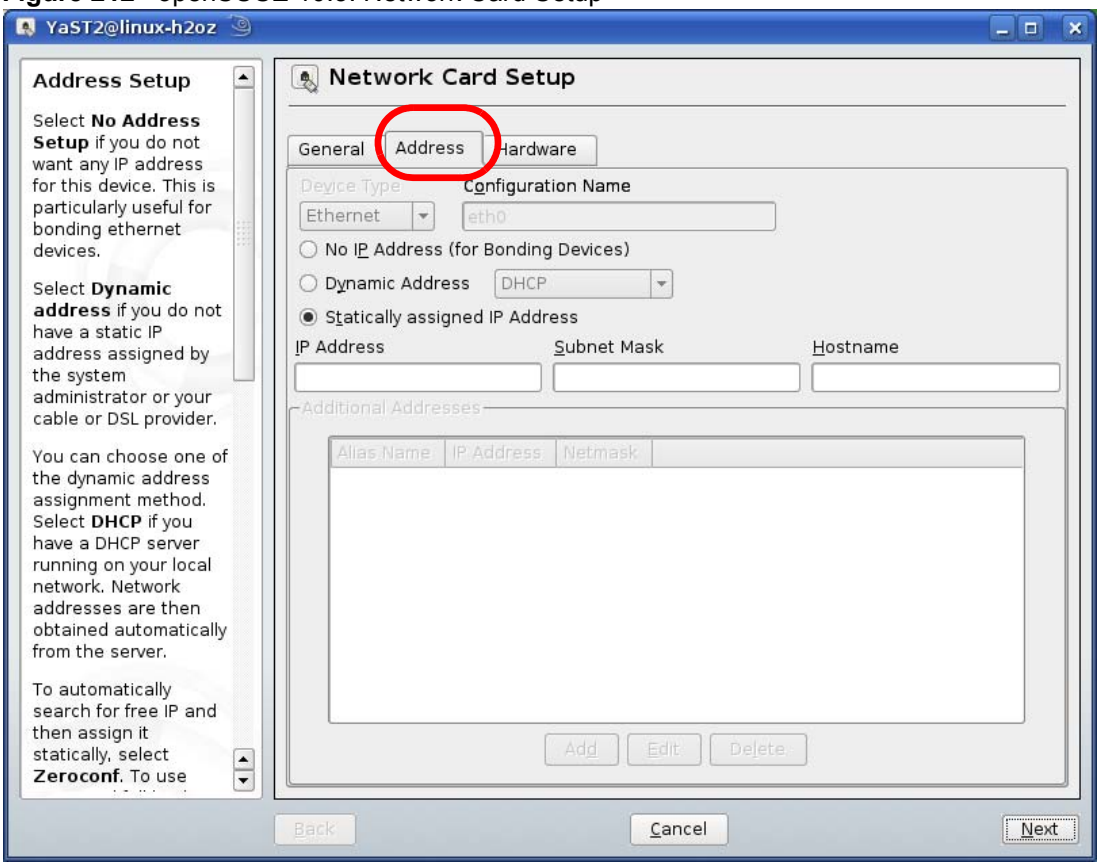
4 When the **Network Settings** window opens, click the **Overview** tab, select the appropriate connection **Name** from the list, and then click the **Configure** button.

Figure 211 openSUSE 10.3: Network Settings



5 When the **Network Card Setup** window opens, click the **Address** tab

Figure 212 openSUSE 10.3: Network Card Setup

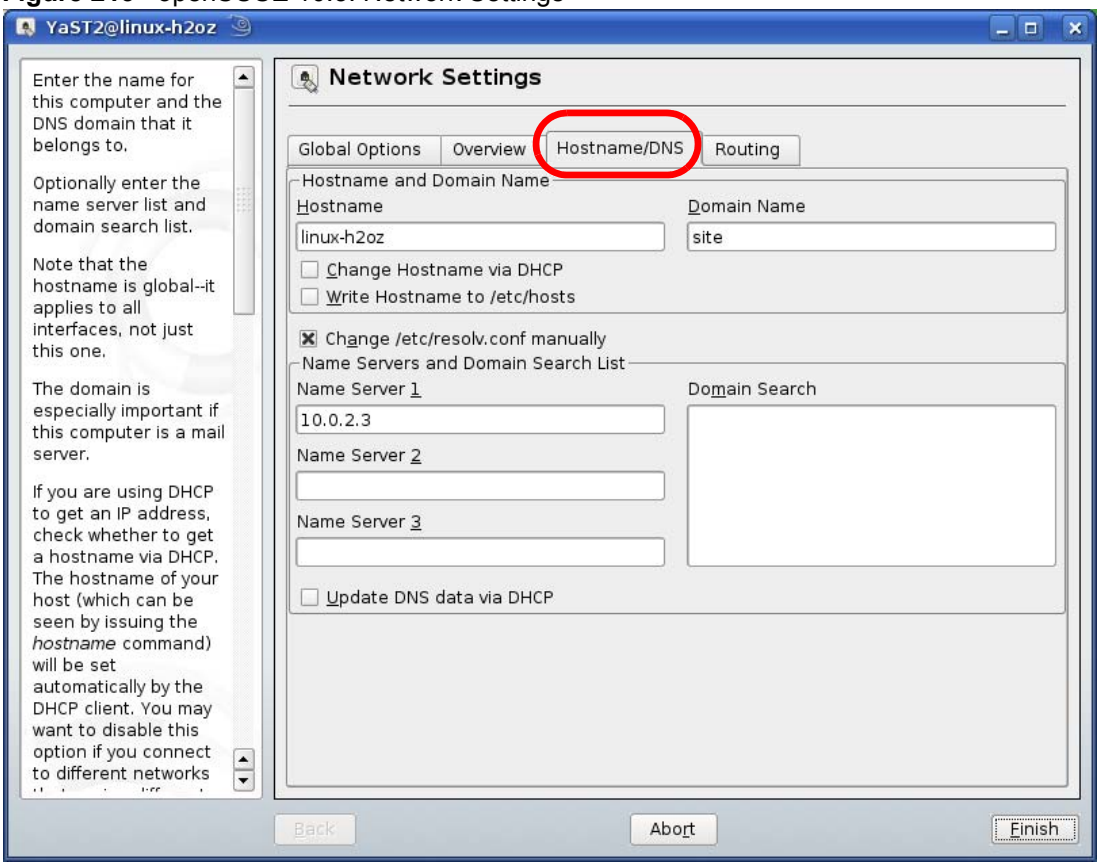

YaST2@linux-h2oz
Address Setup
Select No Address Setup if you do not want any IP address for this device. This is particularly useful for bonding ethernet devices.
Select Dynamic address if you do not have a static IP address assigned by the system administrator or your cable or DSL provider.
You can choose one of the dynamic address assignment method. Select DHCP if you have a DHCP server running on your local network. Network addresses are then obtained automatically from the server.
To automatically search for free IP and then assign it statically, select Zeroconf. To use
Network Card Setup
General
Address
Hardware
Device Type
Configuration Name
Ethernet
eth0
No IP Address (for Bonding Devices)
Dynamic Address
DHCP
Statically assigned IP Address
IP Address
Subnet Mask
Hostname
Additional Addresses
Alias Name
IP Address
Netmask
Add
Edit
Delete
Back
Cancel
Next

6 Select **Dynamic Address (DHCP)** if you have a dynamic IP address.
Select **Statically assigned IP Address** if you have a static IP address. Fill in the **IP address**, **Subnet mask**, and **Hostname** fields.

7 Click **Next** to save the changes and close the **Network Card Setup** window.

8 If you know your DNS server IP address(es), click the **Hostname/DNS** tab in **Network Settings** and then enter the DNS server information in the fields provided.

Figure 213 openSUSE 10.3: Network Settings

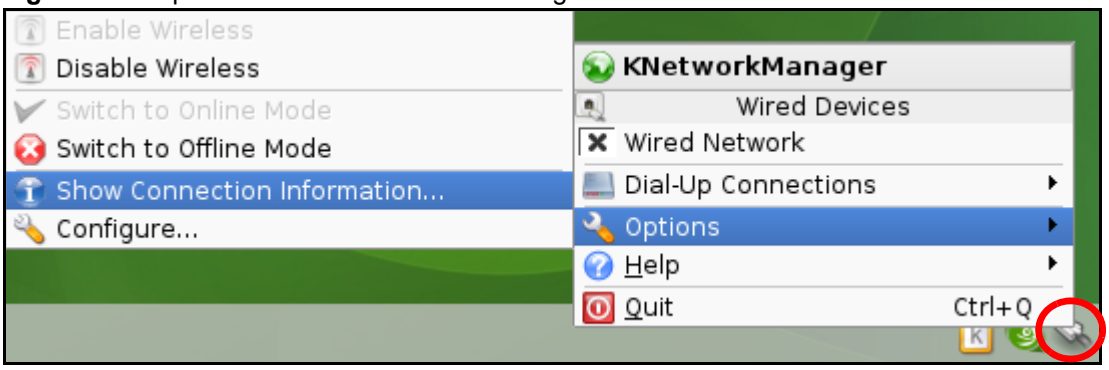

YaST2@linux-h2oz
Enter the name for this computer and the DNS domain that it belongs to.
Optionally enter the name server list and domain search list.
Note that the hostname is global--it applies to all interfaces, not just this one.
The domain is especially important if this computer is a mail server.
If you are using DHCP to get an IP address, check whether to get a hostname via DHCP. The hostname of your host (which can be seen by issuing the hostname command) will be set automatically by the DHCP client. You may want to disable this option if you connect to different networks
Network Settings
Global Options
Overview
Hostname/DNS
Routing
Hostname and Domain Name
Hostname
linux-h2oz
Domain Name
site
Change Hostname via DHCP
Write Hostname to /etc/hosts
Change /etc/resolv.conf manually
Name Servers and Domain Search List
Name Server 1
10.0.2.3
Domain Search
Name Server 2
Name Server 3
Update DNS data via DHCP
Back
Abort
Finish

9 Click **Finish** to save your settings and close the window.

Verifying Settings

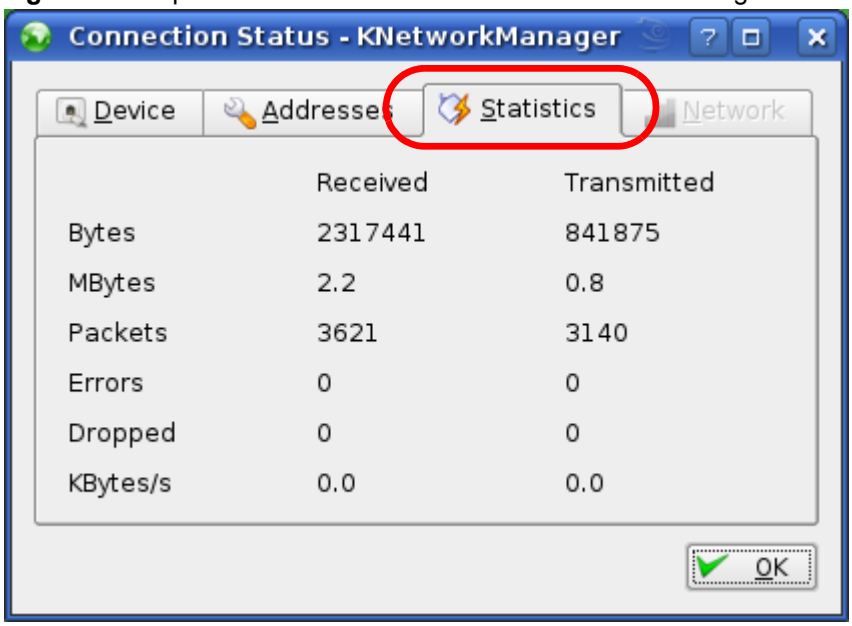
Click the **KNetwork Manager** icon on the **Task bar** to check your TCP/IP properties. From the **Options** sub-menu, select **Show Connection Information**.

Figure 214 openSUSE 10.3: KNetwork Manager



When the **Connection Status - KNetwork Manager** window opens, click the **Statistics tab** to see if your connection is working properly.

Figure 215 openSUSE: Connection Status - KNetwork Manager



B

Pop-up Windows, JavaScripts and Java Permissions

In order to use the web configurator you need to allow:

- Web browser pop-up windows from your device.
- JavaScripts (enabled by default).
- Java permissions (enabled by default).

Internet Explorer 6 screens are used here. Screens for other Internet Explorer versions may vary.

Internet Explorer Pop-up Blockers

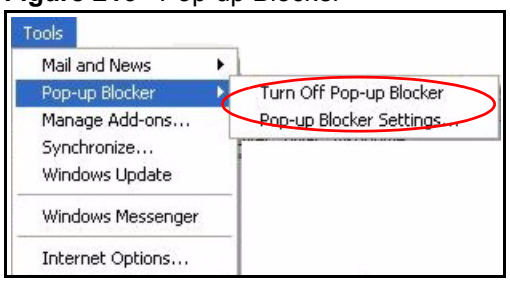
You may have to disable pop-up blocking to log into your device.

Either disable pop-up blocking (enabled by default in Windows XP SP (Service Pack) 2) or allow pop-up blocking and create an exception for your device's IP address.

Disable Pop-up Blockers

1 In Internet Explorer, select **Tools**, **Pop-up Blocker** and then select **Turn Off Pop-up Blocker**.

Figure 216 Pop-up Blocker

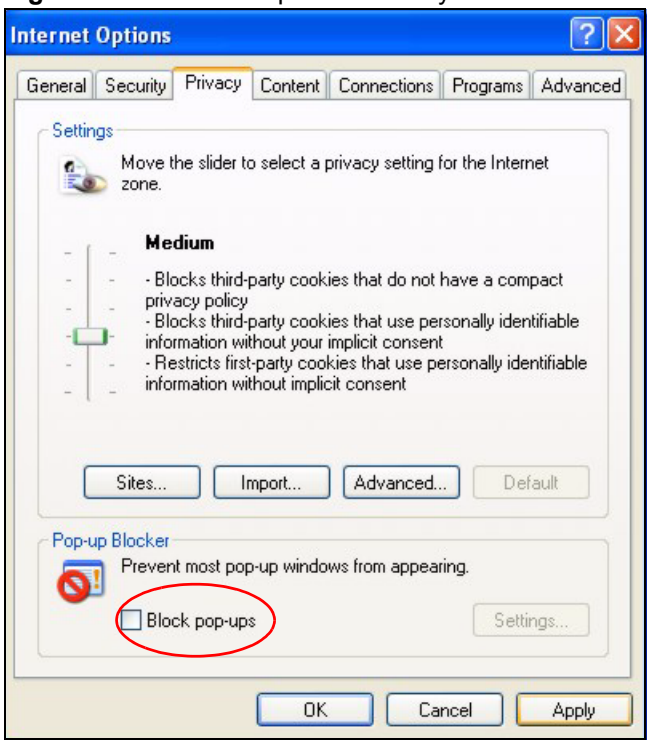


You can also check if pop-up blocking is disabled in the **Pop-up Blocker** section in the **Privacy** tab.

1 In Internet Explorer, select **Tools**, **Internet Options**, **Privacy**.

2 Clear the **Block pop-ups** check box in the **Pop-up Blocker** section of the screen. This disables any web pop-up blockers you may have enabled.

Figure 217 Internet Options: Privacy



3 Click **Apply** to save this setting.

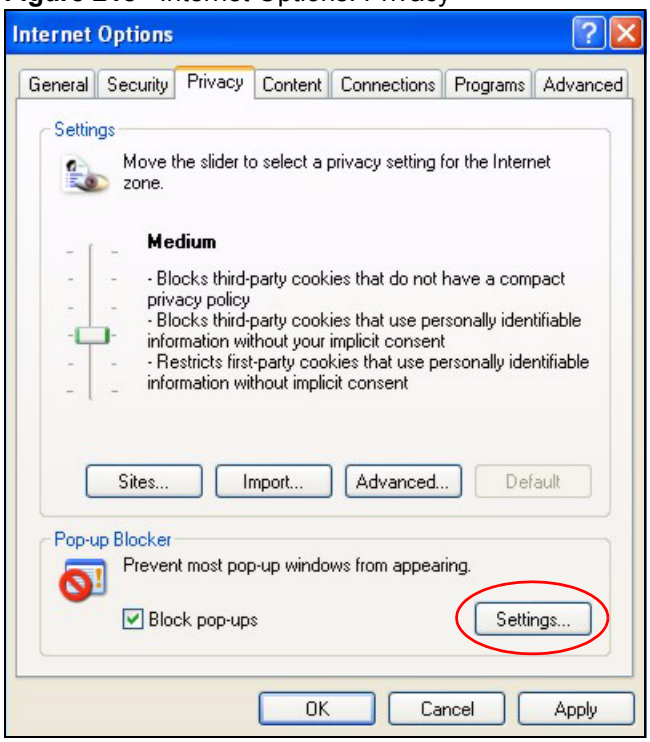
Enable Pop-up Blockers with Exceptions

Alternatively, if you only want to allow pop-up windows from your device, see the following steps.

1 In Internet Explorer, select **Tools**, **Internet Options** and then the **Privacy** tab.

2 Select **Settings…**to open the **Pop-up Blocker Settings** screen.

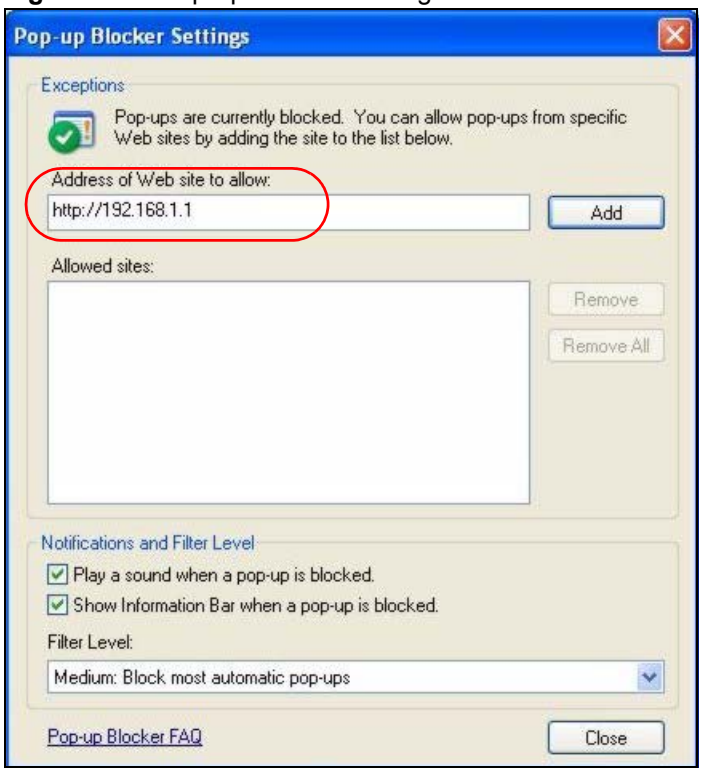
Figure 218 Internet Options: Privacy



3 Type the IP address of your device (the web page that you do not want to have blocked) with the prefix "http://". For example, http://192.168.167.1.

4 Click **Add** to move the IP address to the list of **Allowed sites**.

Figure 219 Pop-up Blocker Settings


Pop-up Blocker Settings
Exceptions
Pop-ups are currently blocked. You can allow pop-ups from specific Web sites by adding the site to the list below.
Address of Web site to allow:
http://192.168.1.1
Add
Allowed sites:
Remove
Remove All
Notifications and Filter Level
Play a sound when a pop-up is blocked.
Show Information Bar when a pop-up is blocked.
Filter Level:
Medium: Block most automatic pop-ups
Pop-up Blocker FAQ
Close

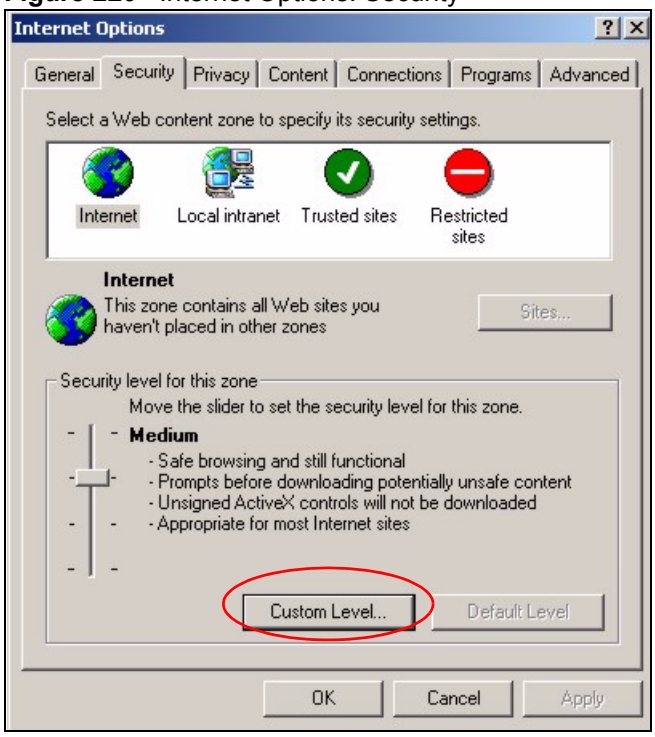
5 Click **Close** to return to the **Privacy** screen.
6 Click **Apply** to save this setting.

JavaScripts

If pages of the web configurator do not display properly in Internet Explorer, check that JavaScripts are allowed.

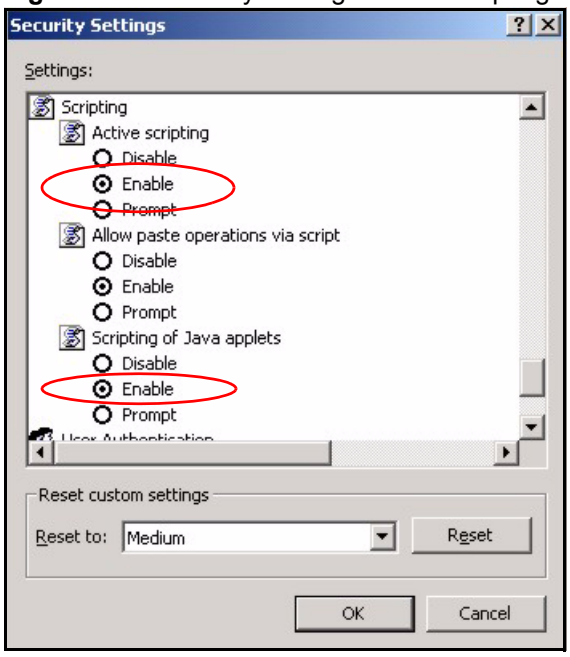
1 In Internet Explorer, click **Tools**, **Internet Options** and then the **Security** tab.

Figure 220 Internet Options: Security



2 Click the **Custom Level...** button.
3 Scroll down to **Scripting**.
4 Under **Active scripting** make sure that **Enable** is selected (the default).
5 Under **Scripting of Java applets** make sure that **Enable** is selected (the default).
6 Click **OK** to close the window.

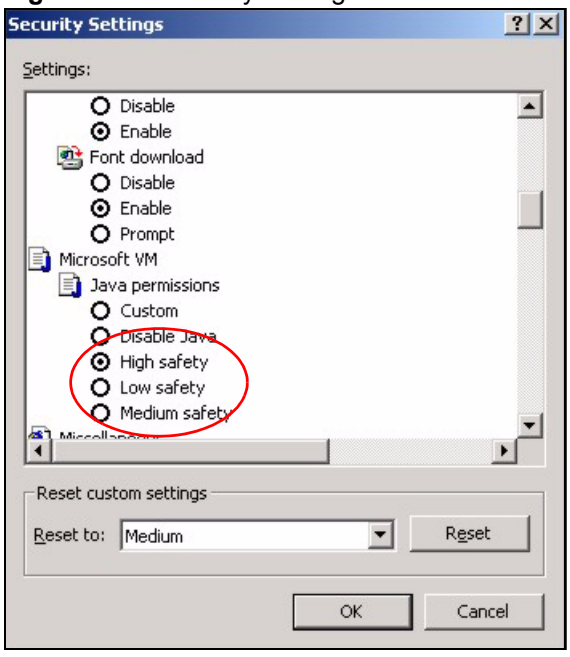
Figure 221 Security Settings - Java Scripting



Java Permissions

1. From Internet Explorer, click **Tools**, **Internet Options** and then the **Security** tab.
2. Click the **Custom Level...** button.
3. Scroll down to **Microsoft VM**.
4. Under **Java permissions** make sure that a safety level is selected.
5. Click **OK** to close the window.

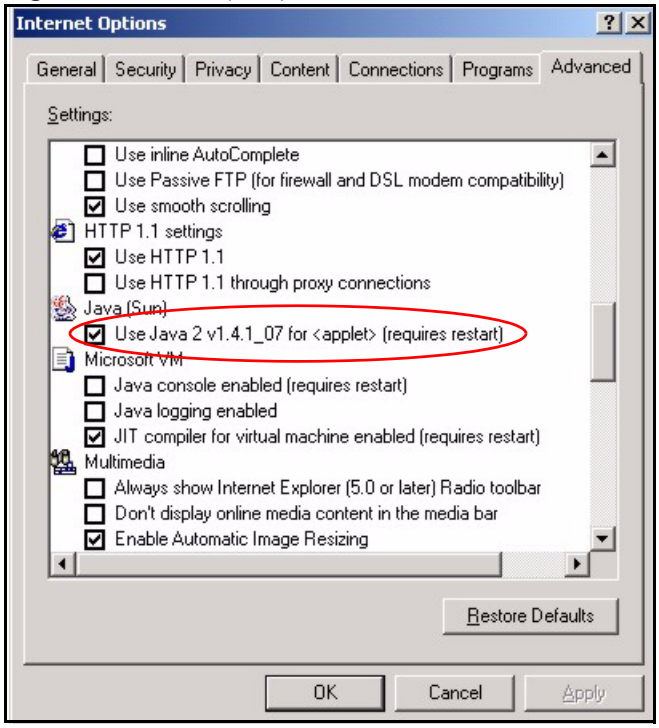
Figure 222 Security Settings - Java



JAVA (Sun)

1 From Internet Explorer, click **Tools**, **Internet Options** and then the **Advanced** tab.
2 Make sure that **Use Java 2 for <applet>** under **Java (Sun)** is selected.
3 Click **OK** to close the window.

Figure 223 Java (Sun)

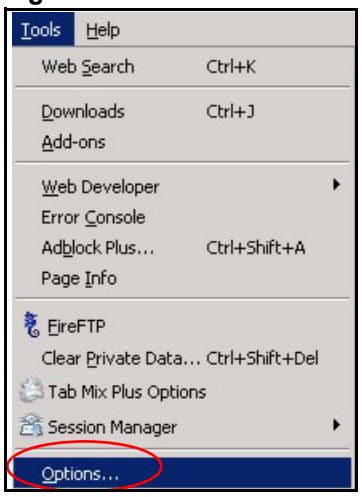


Mozilla Firefox

Mozilla Firefox 2.0 screens are used here. Screens for other versions may vary.

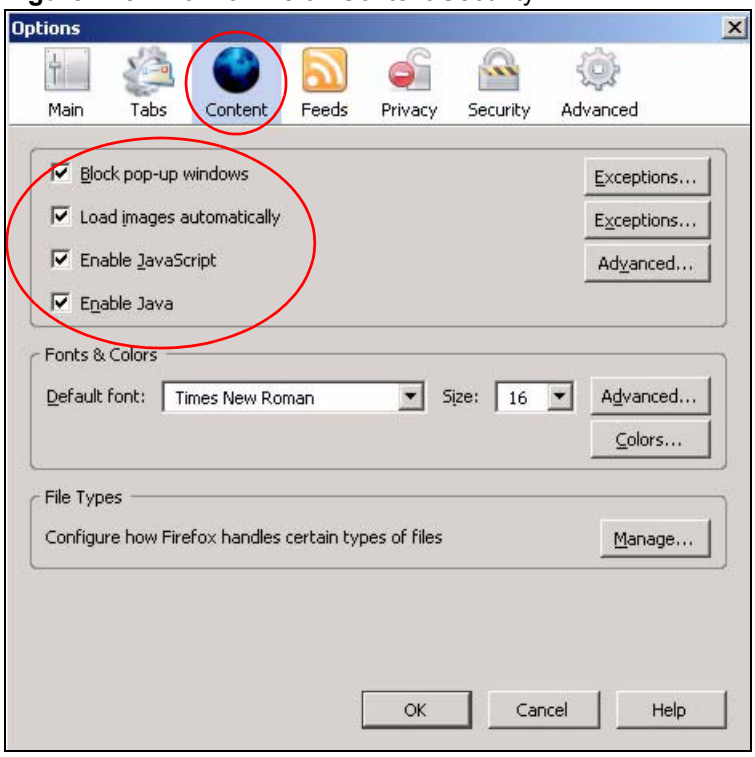
You can enable Java, Javascripts and pop-ups in one screen. Click **Tools,** then click **Options** in the screen that appears.

Figure 224 Mozilla Firefox: Tools > Options



Click **Content**.to show the screen below. Select the check boxes as shown in the following screen.

Figure 225 Mozilla Firefox Content Security



C

IP Addresses and Subnetting

This appendix introduces IP addresses and subnet masks.

IP addresses identify individual devices on a network. Every networking device (including computers, servers, routers, printers, etc.) needs an IP address to communicate across the network. These networking devices are also known as hosts.

Subnet masks determine the maximum number of possible hosts on a network. You can also use subnet masks to divide one network into multiple sub-networks.

Introduction to IP Addresses

One part of the IP address is the network number, and the other part is the host ID. In the same way that houses on a street share a common street name, the hosts on a network share a common network number. Similarly, as each house has its own house number, each host on the network has its own unique identifying number - the host ID. Routers use the network number to send packets to the correct network, while the host ID determines to which host on the network the packets are delivered.

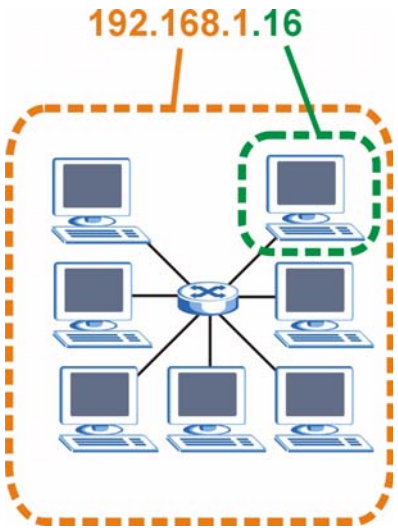
Structure

An IP address is made up of four parts, written in dotted decimal notation (for example, 192.168.1.1). Each of these four parts is known as an octet. An octet is an eight-digit binary number (for example 11000000, which is 192 in decimal notation).

Therefore, each octet has a possible range of 00000000 to 11111111 in binary, or 0 to 255 in decimal.

The following figure shows an example IP address in which the first three octets (192.168.1) are the network number, and the fourth octet (16) is the host ID.

Figure 226 Network Number and Host ID



How much of the IP address is the network number and how much is the host ID varies according to the subnet mask.

Subnet Masks

A subnet mask is used to determine which bits are part of the network number, and which bits are part of the host ID (using a logical AND operation). The term "subnet" is short for "sub-network".

A subnet mask has 32 bits. If a bit in the subnet mask is a "1" then the corresponding bit in the IP address is part of the network number. If a bit in the subnet mask is "0" then the corresponding bit in the IP address is part of the host ID.

The following example shows a subnet mask identifying the network number (in bold text) and host ID of an IP address (192.168.1.2 in decimal).

Table 128 IP Address Network Number and Host ID Example

	1ST OCTET: (192)	2ND OCTET: (168)	3RD OCTET: (1)	4TH OCTET (2)
IP Address (Binary)	11000000	10101000	00000001	00000010
Subnet Mask (Binary)	**11111111**	**11111111**	**11111111**	00000000
Network Number	**11000000**	**10101000**	**00000001**	
Host ID				00000010

By convention, subnet masks always consist of a continuous sequence of ones beginning from the leftmost bit of the mask, followed by a continuous sequence of zeros, for a total number of 32 bits.

Subnet masks can be referred to by the size of the network number part (the bits with a "1" value). For example, an "8-bit mask" means that the first 8 bits of the mask are ones and the remaining 24 bits are zeroes.

Subnet masks are expressed in dotted decimal notation just like IP addresses. The following examples show the binary and decimal notation for 8-bit, 16-bit, 24-bit and 29-bit subnet masks.

Table 129 Subnet Masks

	BINARY				DECIMAL
	1ST OCTET	2ND OCTET	3RD OCTET	4TH OCTET	
8-bit mask	11111111	00000000	00000000	00000000	255.0.0.0
16-bit mask	11111111	11111111	00000000	00000000	255.255.0.0
24-bit mask	11111111	11111111	11111111	00000000	255.255.255.0
29-bit mask	11111111	11111111	11111111	11111000	255.255.255.248

Network Size

The size of the network number determines the maximum number of possible hosts you can have on your network. The larger the number of network number bits, the smaller the number of remaining host ID bits.

An IP address with host IDs of all zeros is the IP address of the network (192.168.1.0 with a 24-bit subnet mask, for example). An IP address with host IDs of all ones is the broadcast address for that network (192.168.1.255 with a 24-bit subnet mask, for example).

As these two IP addresses cannot be used for individual hosts, calculate the maximum number of possible hosts in a network as follows:

Table 130 Maximum Host Numbers

SUBNET MASK		HOST ID SIZE		MAXIMUM NUMBER OF HOSTS
8 bits	255.0.0.0	24 bits	$2^{24} - 2$	16777214
16 bits	255.255.0.0	16 bits	$2^{16} - 2$	65534
24 bits	255.255.255.0	8 bits	$2^{8} - 2$	254
29 bits	255.255.255.248	3 bits	$2^{3} - 2$	6

Notation

Since the mask is always a continuous number of ones beginning from the left, followed by a continuous number of zeros for the remainder of the 32 bit mask, you can simply specify the number of ones instead of writing the value of each octet. This is usually specified by writing a "/" followed by the number of bits in the mask after the address.

For example, 192.1.1.0 /25 is equivalent to saying 192.1.1.0 with subnet mask 255.255.255.128.

The following table shows some possible subnet masks using both notations.

Table 131 Alternative Subnet Mask Notation

SUBNET MASK	ALTERNATIVE NOTATION	LAST OCTET (BINARY)	LAST OCTET (DECIMAL)
255.255.255.0	/24	0000 0000	0
255.255.255.128	/25	1000 0000	128

Table 131 Alternative Subnet Mask Notation (continued)

SUBNET MASK	ALTERNATIVE NOTATION	LAST OCTET (BINARY)	LAST OCTET (DECIMAL)
255.255.255.192	/26	1100 0000	192
255.255.255.224	/27	1110 0000	224
255.255.255.240	/28	1111 0000	240
255.255.255.248	/29	1111 1000	248
255.255.255.252	/30	1111 1100	252

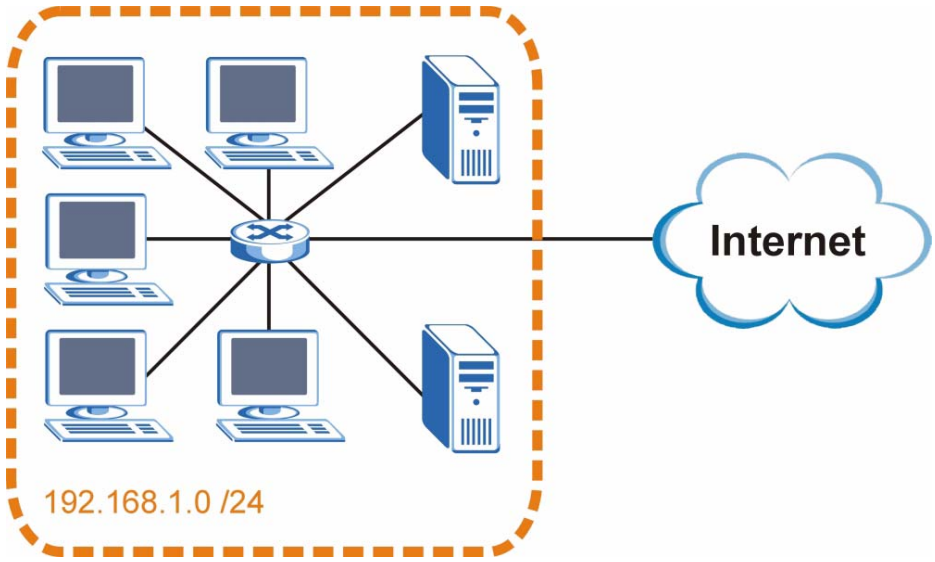
Subnetting

You can use subnetting to divide one network into multiple sub-networks. In the following example a network administrator creates two sub-networks to isolate a group of servers from the rest of the company network for security reasons.

In this example, the company network address is 192.168.1.0. The first three octets of the address (192.168.1) are the network number, and the remaining octet is the host ID, allowing a maximum of $2^8 - 2$ or 254 possible hosts.

The following figure shows the company network before subnetting.

Figure 227 Subnetting Example: Before Subnetting

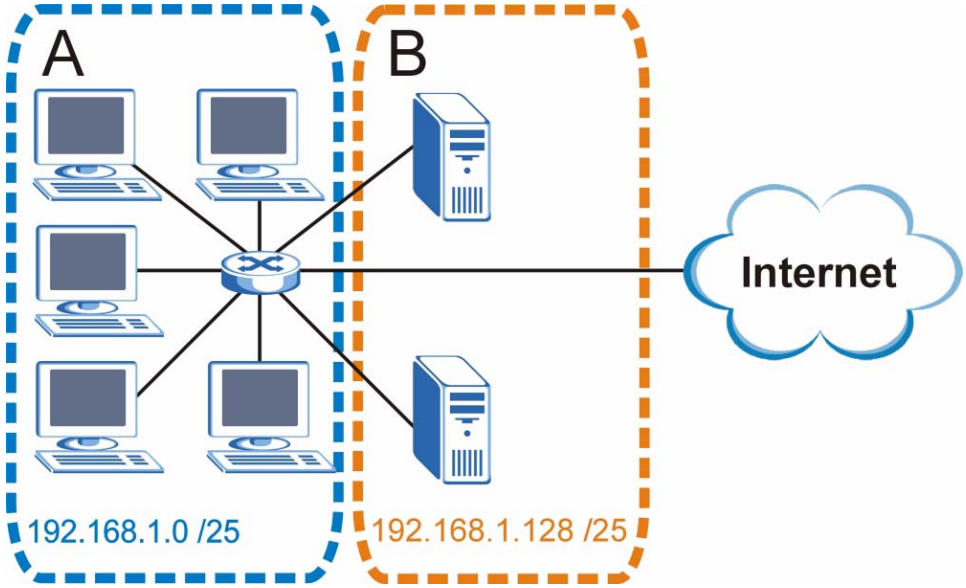


You can "borrow" one of the host ID bits to divide the network 192.168.1.0 into two separate sub-networks. The subnet mask is now 25 bits (255.255.255.128 or /25).

The "borrowed" host ID bit can have a value of either 0 or 1, allowing two subnets; 192.168.1.0 /25 and 192.168.1.128 /25.

The following figure shows the company network after subnetting. There are now two sub-networks, **A** and **B**.

Figure 228 Subnetting Example: After Subnetting



In a 25-bit subnet the host ID has 7 bits, so each sub-network has a maximum of $2^7 - 2$ or 126 possible hosts (a host ID of all zeroes is the subnet's address itself, all ones is the subnet's broadcast address).

192.168.1.0 with mask 255.255.255.128 is subnet **A** itself, and 192.168.1.127 with mask 255.255.255.128 is its broadcast address. Therefore, the lowest IP address that can be assigned to an actual host for subnet **A** is 192.168.1.1 and the highest is 192.168.1.126.

Similarly, the host ID range for subnet **B** is 192.168.1.129 to 192.168.1.254.

Example: Four Subnets

The previous example illustrated using a 25-bit subnet mask to divide a 24-bit address into two subnets. Similarly, to divide a 24-bit address into four subnets, you need to "borrow" two host ID bits to give four possible combinations (00, 01, 10 and 11). The subnet mask is 26 bits (11111111.11111111.11111111.**11**000000) or 255.255.255.192.

Each subnet contains 6 host ID bits, giving 2^6 - 2 or 62 hosts for each subnet (a host ID of all zeroes is the subnet itself, all ones is the subnet's broadcast address).

Table 132 Subnet 1

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address (Decimal)	192.168.1.	0
IP Address (Binary)	11000000.10101000.00000001.	**00**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.0	Lowest Host ID: 192.168.1.1	
Broadcast Address: 192.168.1.63	Highest Host ID: 192.168.1.62	

Table 133 Subnet 2

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	64
IP Address (Binary)	11000000.10101000.00000001.	**01**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.64	Lowest Host ID: 192.168.1.65	
Broadcast Address: 192.168.1.127	Highest Host ID: 192.168.1.126	

Table 134 Subnet 3

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	128
IP Address (Binary)	11000000.10101000.00000001.	**10**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.128	Lowest Host ID: 192.168.1.129	
Broadcast Address: 192.168.1.191	Highest Host ID: 192.168.1.190	

Table 135 Subnet 4

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	192
IP Address (Binary)	11000000.10101000.00000001.	**11**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.192	Lowest Host ID: 192.168.1.193	
Broadcast Address: 192.168.1.255	Highest Host ID: 192.168.1.254	

Example: Eight Subnets

Similarly, use a 27-bit mask to create eight subnets (000, 001, 010, 011, 100, 101, 110 and 111).

The following table shows IP address last octet values for each subnet.

Table 136 Eight Subnets

SUBNET	SUBNET ADDRESS	FIRST ADDRESS	LAST ADDRESS	BROADCAST ADDRESS
1	0	1	30	31
2	32	33	62	63
3	64	65	94	95
4	96	97	126	127

Table 136 Eight Subnets (continued)

SUBNET	SUBNET ADDRESS	FIRST ADDRESS	LAST ADDRESS	BROADCAST ADDRESS
5	128	129	158	159
6	160	161	190	191
7	192	193	222	223
8	224	225	254	255

Subnet Planning

The following table is a summary for subnet planning on a network with a 24-bit network number.

Table 137 24-bit Network Number Subnet Planning

NO. "BORROWED" HOST BITS	SUBNET MASK	NO. SUBNETS	NO. HOSTS PER SUBNET
1	255.255.255.128 (/25)	2	126
2	255.255.255.192 (/26)	4	62
3	255.255.255.224 (/27)	8	30
4	255.255.255.240 (/28)	16	14
5	255.255.255.248 (/29)	32	6
6	255.255.255.252 (/30)	64	2
7	255.255.255.254 (/31)	128	1

The following table is a summary for subnet planning on a network with a 16-bit network number.

Table 138 16-bit Network Number Subnet Planning

NO. "BORROWED" HOST BITS	SUBNET MASK	NO. SUBNETS	NO. HOSTS PER SUBNET
1	255.255.128.0 (/17)	2	32766
2	255.255.192.0 (/18)	4	16382
3	255.255.224.0 (/19)	8	8190
4	255.255.240.0 (/20)	16	4094
5	255.255.248.0 (/21)	32	2046
6	255.255.252.0 (/22)	64	1022
7	255.255.254.0 (/23)	128	510
8	255.255.255.0 (/24)	256	254
9	255.255.255.128 (/25)	512	126
10	255.255.255.192 (/26)	1024	62
11	255.255.255.224 (/27)	2048	30
12	255.255.255.240 (/28)	4096	14
13	255.255.255.248 (/29)	8192	6

Table 138 16-bit Network Number Subnet Planning (continued)

NO. "BORROWED" HOST BITS	SUBNET MASK	NO. SUBNETS	NO. HOSTS PER SUBNET
14	255.255.255.252 (/30)	16384	2
15	255.255.255.254 (/31)	32768	1

Configuring IP Addresses

Where you obtain your network number depends on your particular situation. If the ISP or your network administrator assigns you a block of registered IP addresses, follow their instructions in selecting the IP addresses and the subnet mask.

If the ISP did not explicitly give you an IP network number, then most likely you have a single user account and the ISP will assign you a dynamic IP address when the connection is established. If this is the case, it is recommended that you select a network number from 192.168.0.0 to 192.168.255.0. The Internet Assigned Number Authority (IANA) reserved this block of addresses specifically for private use; please do not use any other number unless you are told otherwise. You must also enable Network Address Translation (NAT) on the ZyXEL Device.

Once you have decided on the network number, pick an IP address for your ZyXEL Device that is easy to remember (for instance, 192.168.1.1) but make sure that no other device on your network is using that IP address.

The subnet mask specifies the network number portion of an IP address. Your ZyXEL Device will compute the subnet mask automatically based on the IP address that you entered. You don't need to change the subnet mask computed by the ZyXEL Device unless you are instructed to do otherwise.

Private IP Addresses

Every machine on the Internet must have a unique address. If your networks are isolated from the Internet (running only between two branch offices, for example) you can assign any IP addresses to the hosts without problems. However, the Internet Assigned Numbers Authority (IANA) has reserved the following three blocks of IP addresses specifically for private networks:

- 10.0.0.0 — 10.255.255.255
- 172.16.0.0 — 172.31.255.255
- 192.168.0.0 — 192.168.255.255

You can obtain your IP address from the IANA, from an ISP, or it can be assigned from a private network. If you belong to a small organization and your Internet access is through an ISP, the ISP can provide you with the Internet addresses for your local networks. On the other hand, if you are part of a much larger organization, you should consult your network administrator for the appropriate IP addresses.

Regardless of your particular situation, do not create an arbitrary IP address; always follow the guidelines above. For more information on address assignment, please refer to RFC 1597, Address Allocation for Private Internets and RFC 1466, Guidelines for Management of IP Address Space.

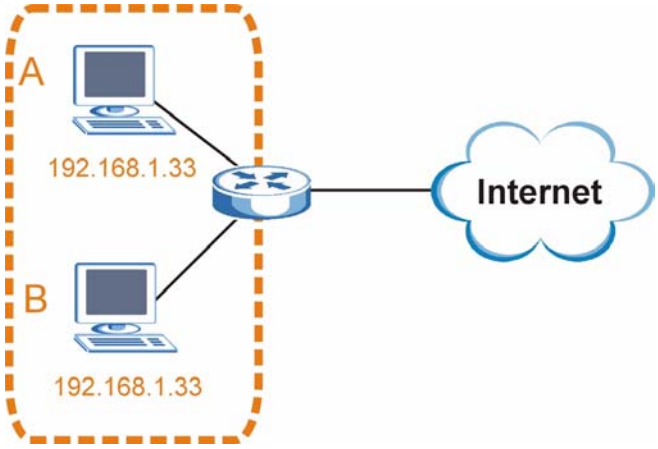
IP Address Conflicts

Each device on a network must have a unique IP address. Devices with duplicate IP addresses on the same network will not be able to access the Internet or other resources. The devices may also be unreachable through the network.

Conflicting Computer IP Addresses Example

More than one device can not use the same IP address. In the following example computer **A** has a static (or fixed) IP address that is the same as the IP address that a DHCP server assigns to computer **B** which is a DHCP client. Neither can access the Internet. This problem can be solved by assigning a different static IP address to computer **A** or setting computer **A** to obtain an IP address automatically.

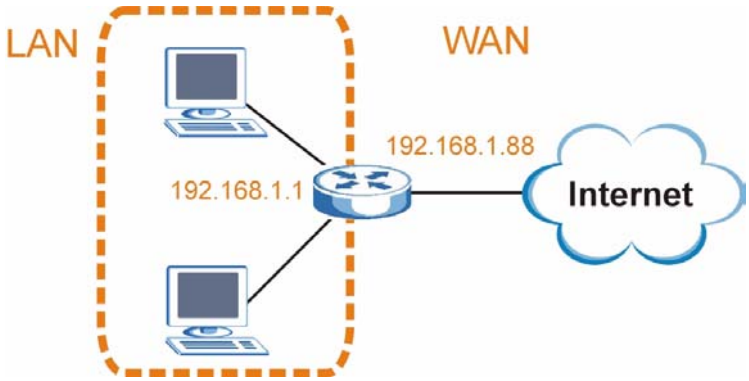
Figure 229 Conflicting Computer IP Addresses Example



Conflicting Router IP Addresses Example

Since a router connects different networks, it must have interfaces using different network numbers. For example, if a router is set between a LAN and the Internet (WAN), the router's LAN and WAN addresses must be on different subnets. In the following example, the LAN and WAN are on the same subnet. The LAN computers cannot access the Internet because the router cannot route between networks.

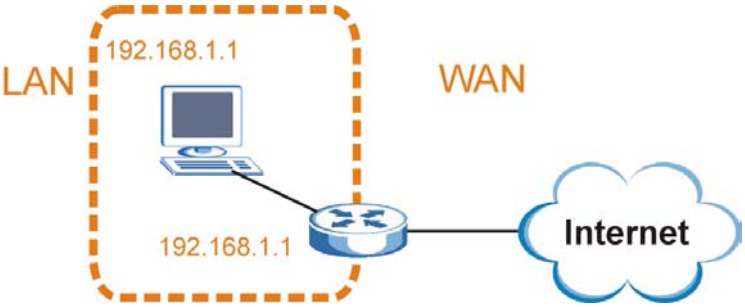
Figure 230 Conflicting Computer IP Addresses Example



Conflicting Computer and Router IP Addresses Example

More than one device can not use the same IP address. In the following example, the computer and the router's LAN port both use 192.168.1.1 as the IP address. The computer cannot access the Internet. This problem can be solved by assigning a different IP address to the computer or the router's LAN port.

Figure 231 Conflicting Computer and Router IP Addresses Example



D

Wireless LANs

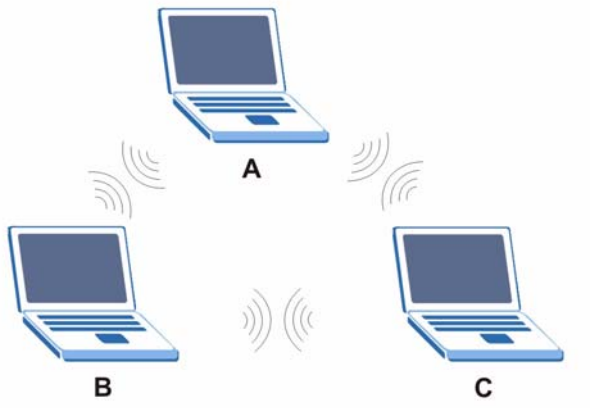
Wireless LAN Topologies

This section discusses ad-hoc and infrastructure wireless LAN topologies.

Ad-hoc Wireless LAN Configuration

The simplest WLAN configuration is an independent (Ad-hoc) WLAN that connects a set of computers with wireless adapters (A, B, C). Any time two or more wireless adapters are within range of each other, they can set up an independent network, which is commonly referred to as an ad-hoc network or Independent Basic Service Set (IBSS). The following diagram shows an example of notebook computers using wireless adapters to form an ad-hoc wireless LAN.

Figure 232 Peer-to-Peer Communication in an Ad-hoc Network

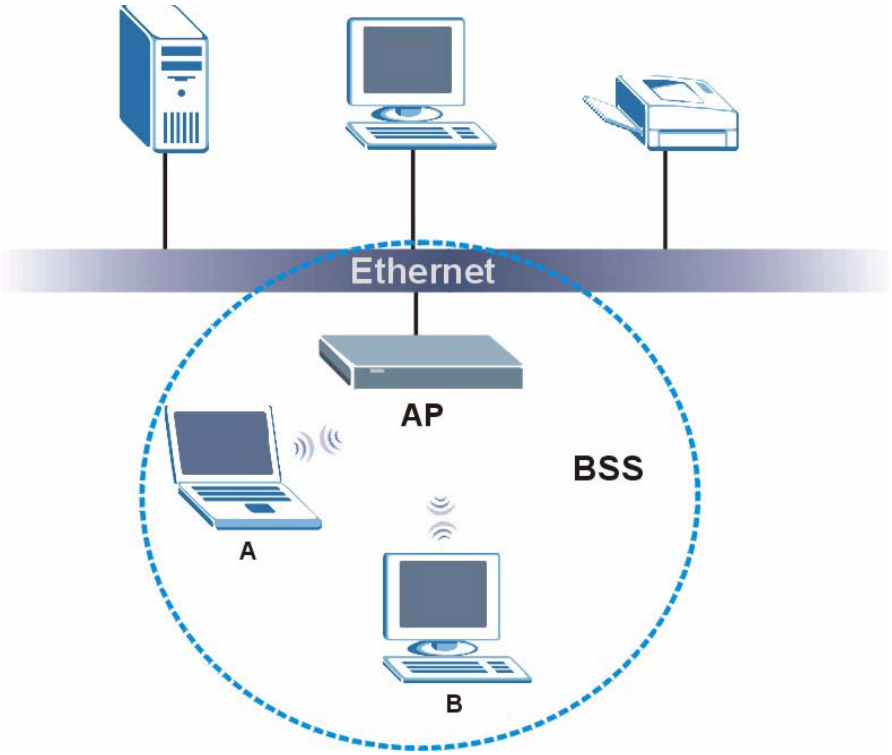


BSS

A Basic Service Set (BSS) exists when all communications between wireless clients or between a wireless client and a wired network client go through one access point (AP).

Intra-BSS traffic is traffic between wireless clients in the BSS. When Intra-BSS is enabled, wireless client **A** and **B** can access the wired network and communicate with each other. When Intra-BSS is disabled, wireless client **A** and **B** can still access the wired network but cannot communicate with each other.

Figure 233 Basic Service Set



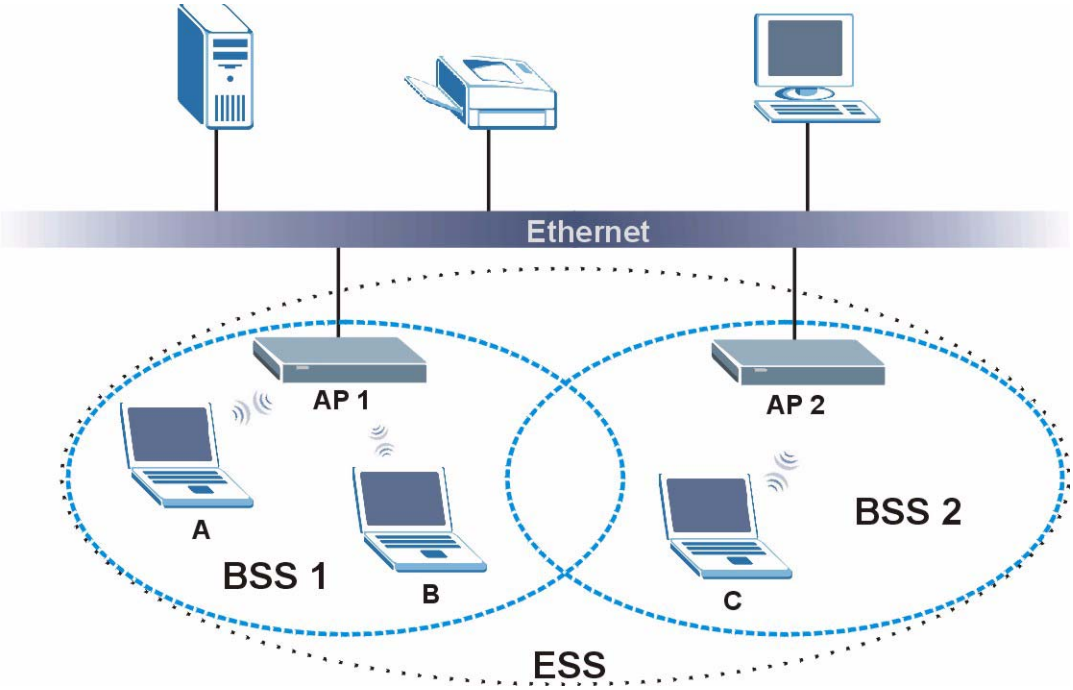
ESS

An Extended Service Set (ESS) consists of a series of overlapping BSSs, each containing an access point, with each access point connected together by a wired network. This wired connection between APs is called a Distribution System (DS).

This type of wireless LAN topology is called an Infrastructure WLAN. The Access Points not only provide communication with the wired network but also mediate wireless network traffic in the immediate neighborhood.

An ESSID (ESS IDentification) uniquely identifies each ESS. All access points and their associated wireless clients within the same ESS must have the same ESSID in order to communicate.

Figure 234 Infrastructure WLAN



Channel

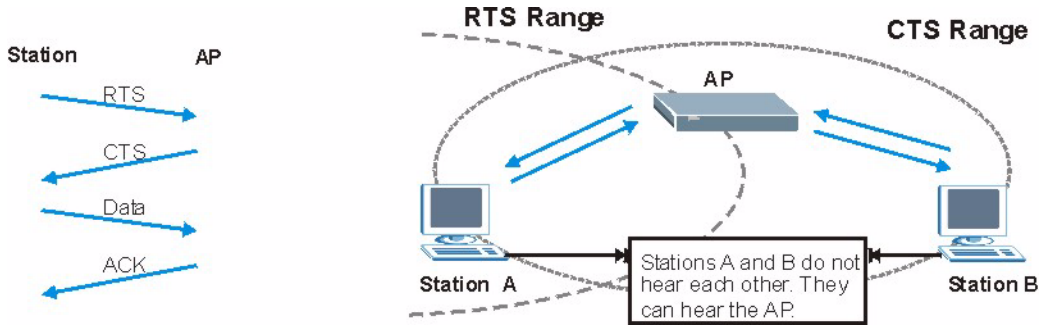
A channel is the radio frequency(ies) used by wireless devices to transmit and receive data. Channels available depend on your geographical area. You may have a choice of channels (for your region) so you should use a channel different from an adjacent AP (access point) to reduce interference. Interference occurs when radio signals from different access points overlap causing interference and degrading performance.

Adjacent channels partially overlap however. To avoid interference due to overlap, your AP should be on a channel at least five channels away from a channel that an adjacent AP is using. For example, if your region has 11 channels and an adjacent AP is using channel 1, then you need to select a channel between 6 or 11.

RTS/CTS

A hidden node occurs when two stations are within range of the same access point, but are not within range of each other. The following figure illustrates a hidden node. Both stations (STA) are within range of the access point (AP) or wireless gateway, but out-of-range of each other, so they cannot "hear" each other, that is they do not know if the channel is currently being used. Therefore, they are considered hidden from each other.

Figure 235 RTS/CTS



When station **A** sends data to the AP, it might not know that the station **B** is already using the channel. If these two stations send data at the same time, collisions may occur when both sets of data arrive at the AP at the same time, resulting in a loss of messages for both stations.

RTS/CTS is designed to prevent collisions due to hidden nodes. An **RTS/CTS** defines the biggest size data frame you can send before an RTS (Request To Send)/CTS (Clear to Send) handshake is invoked.

When a data frame exceeds the **RTS/CTS** value you set (between 0 to 2432 bytes), the station that wants to transmit this frame must first send an RTS (Request To Send) message to the AP for permission to send it. The AP then responds with a CTS (Clear to Send) message to all other stations within its range to notify them to defer their transmission. It also reserves and confirms with the requesting station the time frame for the requested transmission.

Stations can send frames smaller than the specified **RTS/CTS** directly to the AP without the RTS (Request To Send)/CTS (Clear to Send) handshake.

You should only configure **RTS/CTS** if the possibility of hidden nodes exists on your network and the "cost" of resending large frames is more than the extra network overhead involved in the RTS (Request To Send)/CTS (Clear to Send) handshake.

If the **RTS/CTS** value is greater than the **Fragmentation Threshold** value (see next), then the RTS (Request To Send)/CTS (Clear to Send) handshake will never occur as data frames will be fragmented before they reach **RTS/CTS** size.

Enabling the RTS Threshold causes redundant network overhead that could negatively affect the throughput performance instead of providing a remedy.

Fragmentation Threshold

A **Fragmentation Threshold** is the maximum data fragment size (between 256 and 2432 bytes) that can be sent in the wireless network before the AP will fragment the packet into smaller data frames.

A large **Fragmentation Threshold** is recommended for networks not prone to interference while you should set a smaller threshold for busy networks or networks that are prone to interference.

If the **Fragmentation Threshold** value is smaller than the **RTS/CTS** value (see previously) you set then the RTS (Request To Send)/CTS (Clear to Send) handshake will never occur as data frames will be fragmented before they reach **RTS/CTS** size.

Preamble Type

Preamble is used to signal that data is coming to the receiver. Short and long refer to the length of the synchronization field in a packet.

Short preamble increases performance as less time sending preamble means more time for sending data. All IEEE 802.11 compliant wireless adapters support long preamble, but not all support short preamble.

Use long preamble if you are unsure what preamble mode other wireless devices on the network support, and to provide more reliable communications in busy wireless networks.

Use short preamble if you are sure all wireless devices on the network support it, and to provide more efficient communications.

Use the dynamic setting to automatically use short preamble when all wireless devices on the network support it, otherwise the ZyXEL Device uses long preamble.

The wireless devices MUST use the same preamble mode in order to communicate.

IEEE 802.11g Wireless LAN

IEEE 802.11g is fully compatible with the IEEE 802.11b standard. This means an IEEE 802.11b adapter can interface directly with an IEEE 802.11g access point (and vice versa) at 11 Mbps or lower depending on range. IEEE 802.11g has several intermediate rate steps between the maximum and minimum data rates. The IEEE 802.11g data rate and modulation are as follows:

Table 139 IEEE 802.11g

DATA RATE (MBPS)	MODULATION
1	DBPSK (Differential Binary Phase Shift Keyed)
2	DQPSK (Differential Quadrature Phase Shift Keying)
5.5 / 11	CCK (Complementary Code Keying)
6/9/12/18/24/36/48/54	OFDM (Orthogonal Frequency Division Multiplexing)

Wireless Security Overview

Wireless security is vital to your network to protect wireless communication between wireless clients, access points and the wired network.

Wireless security methods available on the ZyXEL Device are data encryption, wireless client authentication, restricting access by device MAC address and hiding the ZyXEL Device identity.

The following figure shows the relative effectiveness of these wireless security methods available on your ZyXEL Device.

Table 140 Wireless Security Levels

SECURITY LEVEL	SECURITY TYPE
Least Secure	Unique SSID (Default)
	Unique SSID with Hide SSID Enabled
	MAC Address Filtering
	WEP Encryption
	IEEE802.1x EAP with RADIUS Server Authentication
	Wi-Fi Protected Access (WPA)
Most Secure	WPA2

You must enable the same wireless security settings on the ZyXEL Device and on all wireless clients that you want to associate with it.

IEEE 802.1x

In June 2001, the IEEE 802.1x standard was designed to extend the features of IEEE 802.11 to support extended authentication as well as providing additional accounting and control features. It is supported by Windows XP and a number of network devices. Some advantages of IEEE 802.1x are:

- User based identification that allows for roaming.
- Support for RADIUS (Remote Authentication Dial In User Service, RFC 2138, 2139) for centralized user profile and accounting management on a network RADIUS server.
- Support for EAP (Extensible Authentication Protocol, RFC 2486) that allows additional authentication methods to be deployed with no changes to the access point or the wireless clients.

RADIUS

RADIUS is based on a client-server model that supports authentication, authorization and accounting. The access point is the client and the server is the RADIUS server. The RADIUS server handles the following tasks:

- Authentication
  Determines the identity of the users.
- Authorization

Determines the network services available to authenticated users once they are connected to the network.

- Accounting
  Keeps track of the client's network activity.

RADIUS is a simple package exchange in which your AP acts as a message relay between the wireless client and the network RADIUS server.

Types of RADIUS Messages

The following types of RADIUS messages are exchanged between the access point and the RADIUS server for user authentication:

- Access-Request
  Sent by an access point requesting authentication.
- Access-Reject
  Sent by a RADIUS server rejecting access.
- Access-Accept
  Sent by a RADIUS server allowing access.
- Access-Challenge
  Sent by a RADIUS server requesting more information in order to allow access. The access point sends a proper response from the user and then sends another Access-Request message.

The following types of RADIUS messages are exchanged between the access point and the RADIUS server for user accounting:

- Accounting-Request
  Sent by the access point requesting accounting.
- Accounting-Response
  Sent by the RADIUS server to indicate that it has started or stopped accounting.

In order to ensure network security, the access point and the RADIUS server use a shared secret key, which is a password, they both know. The key is not sent over the network. In addition to the shared key, password information exchanged is also encrypted to protect the network from unauthorized access.

Types of EAP Authentication

This section discusses some popular authentication types: EAP-MD5, EAP-TLS, EAP-TTLS, PEAP and LEAP. Your wireless LAN device may not support all authentication types.

EAP (Extensible Authentication Protocol) is an authentication protocol that runs on top of the IEEE 802.1x transport mechanism in order to support multiple types of user authentication. By using EAP to interact with an EAP-compatible RADIUS server, an access point helps a wireless station and a RADIUS server perform authentication.

The type of authentication you use depends on the RADIUS server and an intermediary AP(s) that supports IEEE 802.1x. .

For EAP-TLS authentication type, you must first have a wired connection to the network and obtain the certificate(s) from a certificate authority (CA). A certificate (also called digital IDs) can be used to authenticate users and a CA issues certificates and guarantees the identity of each certificate owner.

EAP-MD5 (Message-Digest Algorithm 5)

MD5 authentication is the simplest one-way authentication method. The authentication server sends a challenge to the wireless client. The wireless client 'proves' that it knows the password by encrypting the password with the challenge and sends back the information. Password is not sent in plain text.

However, MD5 authentication has some weaknesses. Since the authentication server needs to get the plaintext passwords, the passwords must be stored. Thus someone other than the authentication server may access the password file. In addition, it is possible to impersonate an authentication server as MD5 authentication method does not perform mutual authentication. Finally, MD5 authentication method does not support data encryption with dynamic session key. You must configure WEP encryption keys for data encryption.

EAP-TLS (Transport Layer Security)

With EAP-TLS, digital certifications are needed by both the server and the wireless clients for mutual authentication. The server presents a certificate to the client. After validating the identity of the server, the client sends a different certificate to the server. The exchange of certificates is done in the open before a secured tunnel is created. This makes user identity vulnerable to passive attacks. A digital certificate is an electronic ID card that authenticates the sender's identity. However, to implement EAP-TLS, you need a Certificate Authority (CA) to handle certificates, which imposes a management overhead.

EAP-TTLS (Tunneled Transport Layer Service)

EAP-TTLS is an extension of the EAP-TLS authentication that uses certificates for only the server-side authentications to establish a secure connection. Client authentication is then done by sending username and password through the secure connection, thus client identity is protected. For client authentication, EAP-TTLS supports EAP methods and legacy authentication methods such as PAP, CHAP, MS-CHAP and MS-CHAP v2.

PEAP (Protected EAP)

Like EAP-TTLS, server-side certificate authentication is used to establish a secure connection, then use simple username and password methods through the secured connection to authenticate the clients, thus hiding client identity. However, PEAP only supports EAP methods, such as EAP-MD5, EAP-MSCHAPv2 and EAP-GTC (EAP-Generic Token Card), for client authentication. EAP-GTC is implemented only by Cisco.

LEAP

LEAP (Lightweight Extensible Authentication Protocol) is a Cisco implementation of IEEE 802.1x.

Dynamic WEP Key Exchange

The AP maps a unique key that is generated with the RADIUS server. This key expires when the wireless connection times out, disconnects or reauthentication times out. A new WEP key is generated each time reauthentication is performed.

If this feature is enabled, it is not necessary to configure a default encryption key in the wireless security configuration screen. You may still configure and store keys, but they will not be used while dynamic WEP is enabled.

EAP-MD5 cannot be used with Dynamic WEP Key Exchange

For added security, certificate-based authentications (EAP-TLS, EAP-TTLS and PEAP) use dynamic keys for data encryption. They are often deployed in corporate environments, but for public deployment, a simple user name and password pair is more practical. The following table is a comparison of the features of authentication types.

Table 141 Comparison of EAP Authentication Types

	EAP-MD5	EAP-TLS	EAP-TTLS	PEAP	LEAP
Mutual Authentication	No	Yes	Yes	Yes	Yes
Certificate – Client	No	Yes	Optional	Optional	No
Certificate – Server	No	Yes	Yes	Yes	No
Dynamic Key Exchange	No	Yes	Yes	Yes	Yes
Credential Integrity	None	Strong	Strong	Strong	Moderate
Deployment Difficulty	Easy	Hard	Moderate	Moderate	Moderate
Client Identity Protection	No	No	Yes	Yes	No

WPA and WPA2

Wi-Fi Protected Access (WPA) is a subset of the IEEE 802.11i standard. WPA2 (IEEE 802.11i) is a wireless security standard that defines stronger encryption, authentication and key management than WPA.

Key differences between WPA or WPA2 and WEP are improved data encryption and user authentication.

If both an AP and the wireless clients support WPA2 and you have an external RADIUS server, use WPA2 for stronger data encryption. If you don't have an external RADIUS server, you should use WPA2-PSK (WPA2-Pre-Shared Key) that only requires a single (identical) password entered into each access point, wireless gateway and wireless client. As long as the passwords match, a wireless client will be granted access to a WLAN.

If the AP or the wireless clients do not support WPA2, just use WPA or WPA-PSK depending on whether you have an external RADIUS server or not.

Select WEP only when the AP and/or wireless clients do not support WPA or WPA2. WEP is less secure than WPA or WPA2.

Encryption

WPA improves data encryption by using Temporal Key Integrity Protocol (TKIP), Message Integrity Check (MIC) and IEEE 802.1x. WPA2 also uses TKIP when required for compatibility reasons, but offers stronger encryption than TKIP with Advanced Encryption Standard (AES) in the Counter mode with Cipher block chaining Message authentication code Protocol (CCMP).

TKIP uses 128-bit keys that are dynamically generated and distributed by the authentication server. AES (Advanced Encryption Standard) is a block cipher that uses a 256-bit mathematical algorithm called Rijndael. They both include a per-packet key mixing function, a Message Integrity Check (MIC) named Michael, an extended initialization vector (IV) with sequencing rules, and a re-keying mechanism.

WPA and WPA2 regularly change and rotate the encryption keys so that the same encryption key is never used twice.

The RADIUS server distributes a Pairwise Master Key (PMK) key to the AP that then sets up a key hierarchy and management system, using the PMK to dynamically generate unique data encryption keys to encrypt every data packet that is wirelessly communicated between the AP and the wireless clients. This all happens in the background automatically.

The Message Integrity Check (MIC) is designed to prevent an attacker from capturing data packets, altering them and resending them. The MIC provides a strong mathematical function in which the receiver and the transmitter each compute and then compare the MIC. If they do not match, it is assumed that the data has been tampered with and the packet is dropped.

By generating unique data encryption keys for every data packet and by creating an integrity checking mechanism (MIC), with TKIP and AES it is more difficult to decrypt data on a Wi-Fi network than WEP and difficult for an intruder to break into the network.

The encryption mechanisms used for WPA(2) and WPA(2)-PSK are the same. The only difference between the two is that WPA(2)-PSK uses a simple common password, instead of user-specific credentials. The common-password approach makes WPA(2)-PSK susceptible to brute-force password-guessing attacks but it's still an improvement over WEP as it employs a consistent, single, alphanumeric password to derive a PMK which is used to generate unique temporal encryption keys. This prevent all wireless devices sharing the same encryption keys. (a weakness of WEP)

User Authentication

WPA and WPA2 apply IEEE 802.1x and Extensible Authentication Protocol (EAP) to authenticate wireless clients using an external RADIUS database. WPA2 reduces the number of key exchange messages from six to four (CCMP 4-way handshake) and shortens the time required to connect to a network. Other WPA2 authentication features that are different from WPA include key caching and pre-authentication. These two features are optional and may not be supported in all wireless devices.

Key caching allows a wireless client to store the PMK it derived through a successful authentication with an AP. The wireless client uses the PMK when it tries to connect to the same AP and does not need to go with the authentication process again.

Pre-authentication enables fast roaming by allowing the wireless client (already connecting to an AP) to perform IEEE 802.1x authentication with another AP before connecting to it.

Wireless Client WPA Supplicants

A wireless client supplicant is the software that runs on an operating system instructing the wireless client how to use WPA. At the time of writing, the most widely available supplicant is the WPA patch for Windows XP, Funk Software's Odyssey client.

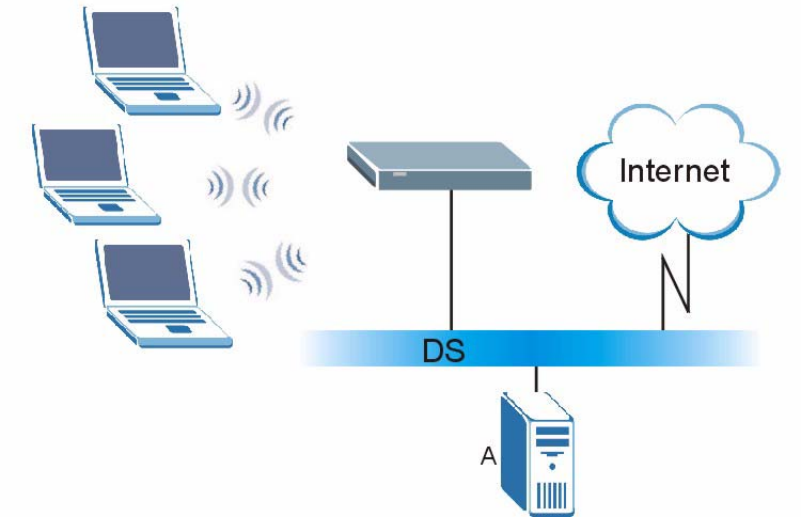
The Windows XP patch is a free download that adds WPA capability to Windows XP's built-in "Zero Configuration" wireless client. However, you must run Windows XP to use it.

WPA(2) with RADIUS Application Example

To set up WPA(2), you need the IP address of the RADIUS server, its port number (default is 1812), and the RADIUS shared secret. A WPA(2) application example with an external RADIUS server looks as follows. "A" is the RADIUS server. "DS" is the distribution system.

1. The AP passes the wireless client's authentication request to the RADIUS server.
2. The RADIUS server then checks the user's identification against its database and grants or denies network access accordingly.
3. A 256-bit Pairwise Master Key (PMK) is derived from the authentication process by the RADIUS server and the client.
4. The RADIUS server distributes the PMK to the AP. The AP then sets up a key hierarchy and management system, using the PMK to dynamically generate unique data encryption keys. The keys are used to encrypt every data packet that is wirelessly communicated between the AP and the wireless clients.

Figure 236 WPA(2) with RADIUS Application Example



WPA(2)-PSK Application Example

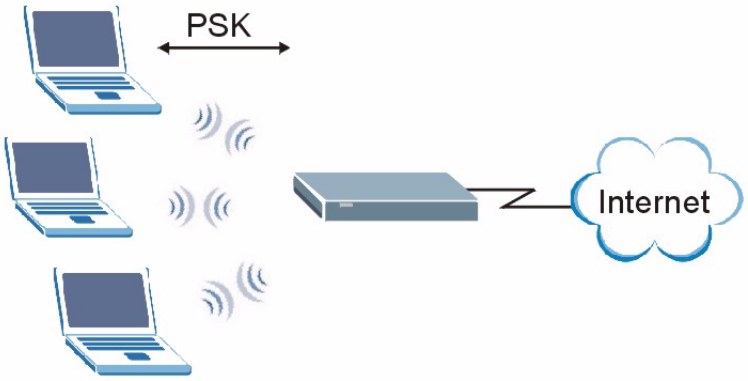
A WPA(2)-PSK application looks as follows.

1. First enter identical passwords into the AP and all wireless clients. The Pre-Shared Key (PSK) must consist of between 8 and 63 ASCII characters or 64 hexadecimal characters (including spaces and symbols).
2. The AP checks each wireless client's password and allows it to join the network only if the password matches.

3 The AP and wireless clients generate a common PMK (Pairwise Master Key). The key itself is not sent over the network, but is derived from the PSK and the SSID.

4 The AP and wireless clients use the TKIP or AES encryption process, the PMK and information exchanged in a handshake to create temporal encryption keys. They use these keys to encrypt data exchanged between them.

Figure 237 WPA(2)-PSK Authentication



Security Parameters Summary

Refer to this table to see what other security parameters you should configure for each authentication method or key management protocol type. MAC address filters are not dependent on how you configure these security features.

Table 142 Wireless Security Relational Matrix

AUTHENTICATION METHOD/ KEY MANAGEMENT PROTOCOL	ENCRYPTION METHOD	ENTER MANUAL KEY	IEEE 802.1X
Open	None	No	Disable
			Enable without Dynamic WEP Key
Open	WEP	No	Enable with Dynamic WEP Key
		Yes	Enable without Dynamic WEP Key
		Yes	Disable
Shared	WEP	No	Enable with Dynamic WEP Key
		Yes	Enable without Dynamic WEP Key
		Yes	Disable
WPA	TKIP/AES	No	Enable
WPA-PSK	TKIP/AES	Yes	Disable
WPA2	TKIP/AES	No	Enable
WPA2-PSK	TKIP/AES	Yes	Disable

Antenna Overview

An antenna couples RF signals onto air. A transmitter within a wireless device sends an RF signal to the antenna, which propagates the signal through the air. The antenna also operates in reverse by capturing RF signals from the air.

Positioning the antennas properly increases the range and coverage area of a wireless LAN.

Antenna Characteristics

Frequency

An antenna in the frequency of 2.4GHz (IEEE 802.11b and IEEE 802.11g) or 5GHz (IEEE 802.11a) is needed to communicate efficiently in a wireless LAN

Radiation Pattern

A radiation pattern is a diagram that allows you to visualize the shape of the antenna's coverage area.

Antenna Gain

Antenna gain, measured in dB (decibel), is the increase in coverage within the RF beam width. Higher antenna gain improves the range of the signal for better communications.

For an indoor site, each 1 dB increase in antenna gain results in a range increase of approximately 2.5%. For an unobstructed outdoor site, each 1dB increase in gain results in a range increase of approximately 5%. Actual results may vary depending on the network environment.

Antenna gain is sometimes specified in dBi, which is how much the antenna increases the signal power compared to using an isotropic antenna. An isotropic antenna is a theoretical perfect antenna that sends out radio signals equally well in all directions. dBi represents the true gain that the antenna provides.

Types of Antennas for WLAN

There are two types of antennas used for wireless LAN applications.

- Omni-directional antennas send the RF signal out in all directions on a horizontal plane. The coverage area is torus-shaped (like a donut) which makes these antennas ideal for a room environment. With a wide coverage area, it is possible to make circular overlapping coverage areas with multiple access points.
- Directional antennas concentrate the RF signal in a beam, like a flashlight does with the light from its bulb. The angle of the beam determines the width of the coverage pattern. Angles typically range from 20 degrees (very directional) to 120 degrees (less directional). Directional antennas are ideal for hallways and outdoor point-to-point applications.

Positioning Antennas

In general, antennas should be mounted as high as practically possible and free of obstructions. In point-to–point application, position both antennas at the same height and in a direct line of sight to each other to attain the best performance.

For omni-directional antennas mounted on a table, desk, and so on, point the antenna up. For omni-directional antennas mounted on a wall or ceiling, point the antenna down. For a single AP application, place omni-directional antennas as close to the center of the coverage area as possible.

For directional antennas, point the antenna in the direction of the desired coverage area.

E

Command Interpreter

The following describes how to use the command interpreter. See the included disk or zyxel.com for more detailed information on these commands.

Use of undocumented commands or misconfiguration can damage the unit and possibly render it unusable.

Command Syntax

- The command keywords are in `courier new` font.
- Enter the command keywords exactly as shown, do not abbreviate.
- The required fields in a command are enclosed in angle brackets <>.
- The optional fields in a command are enclosed in square brackets `[]`.
- The `|` symbol means or.
  For example,
  sys filter netbios config <type> <on|off>
  means that you must specify the type of netbios filter and whether to turn it on or off.

Command Usage

A list of valid commands can be found by typing `help` or `?` at the command prompt. Always type the full command. Type `exit` to close the session when finished.

Command Examples

This section provides some examples of commands you can use on the ZyXEL Device. This list is intended as a general reference of examples. The commands available in your ZyXEL Device may differ from the examples given here. See the other appendices for more examples.

Configuring What You Want the ZyXEL Device to Log

1. Use the `sys logs load` command to load the log setting buffer that allows you to configure which logs the ZyXEL Device is to record.
2. Use `sys logs category` to view a list of the log categories.

Figure 238 Displaying Log Categories Example

```
ras> sys logs category
8021x           access          attack          display
error           icmp            ike             ipsec
javablocked     mten            packetfilter    ppp
cdr             pki             tls             remote
tcpreset        traffic         upnp            urlblocked
urlforward      wireless
```

3. Use `sys logs category` followed by a log category to display the parameters that are available for the category.

Figure 239 Displaying Log Parameters Example

```
ras> sys logs category access
Usage: [0:none/1:log/2:alert/3:both] [0:don't show debug type/1:show debug
type]
```

4. Use `sys logs category` followed by a log category and a parameter to decide what to record.

   Use 0 to not record logs for that category, 1 to record only logs for that category, 2 to record only alerts for that category, and 3 to record both logs and alerts for that category. Not every parameter is available with every category.
5. Use the `sys logs save` command to store the settings in the ZyXEL Device (you must do this in order to record logs).

Displaying Logs

- Use the `sys logs display` command to show all of the logs in the ZyXEL Device's log.
- Use the `sys logs category display` command to show the log settings for all of the log categories.
- Use the `sys logs display [log category]` command to show the logs in an individual ZyXEL Device log category.
- Use the `sys logs clear` command to erase all of the ZyXEL Device's logs.

Log Command Example

This example shows how to set the ZyXEL Device to record the access logs and alerts and then view the results.

```
ras> sys logs load
ras> sys logs category access 3
ras> sys logs save
ras> sys logs display access

#  .time                 source                 destination            notes

    message
  0|06/08/2004 05:58:21 |172.21.4.154          |224.0.1.24            |ACCESS
BLOCK
    Firewall default policy: IGMP (W to W/ZW)
  1|06/08/2004 05:58:20 |172.21.3.56           |239.255.255.250       |ACCESS
BLOCK
    Firewall default policy: IGMP (W to W/ZW)
  2|06/08/2004 05:58:20 |172.21.0.2            |239.255.255.254       |ACCESS
BLOCK
    Firewall default policy: IGMP (W to W/ZW)
  3|06/08/2004 05:58:20 |172.21.3.191          |224.0.1.22            |ACCESS
BLOCK
    Firewall default policy: IGMP (W to W/ZW)
  4|06/08/2004 05:58:20 |172.21.0.254          |224.0.0.1             |ACCESS
BLOCK
    Firewall default policy: IGMP (W to W/ZW)
  5|06/08/2004 05:58:20 |172.21.4.187:137      |172.21.255.255:137    |ACCESS
BLOCK
    Firewall default policy: UDP (W to W/ZW)
```

Routing Command

Syntax: `ip nat routing [0:LAN] [0:no|1:yes]`

Use this command to set the ZyXEL Device to route traffic that does not match a NAT rule through a specific interface. An example of when you may want to use this is if you have servers with public IP addresses connected to the LAN.

The following command example sets the ZyXEL Device to route traffic that does not match a NAT rule through the LAN interface.

Figure 240 Routing Command Example

```
ras> ip nat routing 2 0
Routing can work in NAT when no NAT rule match.
-----------------------------------------------
         LAN: yes
```

ARP Behavior and the ARP ackGratuitous Commands

The ZyXEL Device does not accept ARP reply information if the ZyXEL Device did not send out a corresponding request. This helps prevent the ZyXEL Device from updating its ARP table with an incorrect IP address to MAC address mapping due to a spoofed ARP. An incorrect IP to MAC address mapping in the ZyXEL Device's ARP table could cause the ZyXEL Device to send packets to the wrong device.

Commands for Using or Ignoring Gratuitous ARP Requests

A host can send an ARP request to resolve its own IP address. This is called a gratuitous ARP request. The packet uses the host's own IP address as the source and destination IP address. The packet uses the Ethernet broadcast address (FF:FF:FF:FF:FF:FF) as the destination MAC address. This is used to determine if any other hosts on the network are using the same IP address as the sending host. The other hosts in the network can also update their ARP table IP address to MAC address mappings with this host's MAC address.

The `ip arp ackGratuitous` commands set how the ZyXEL Device handles gratuitous ARP requests.

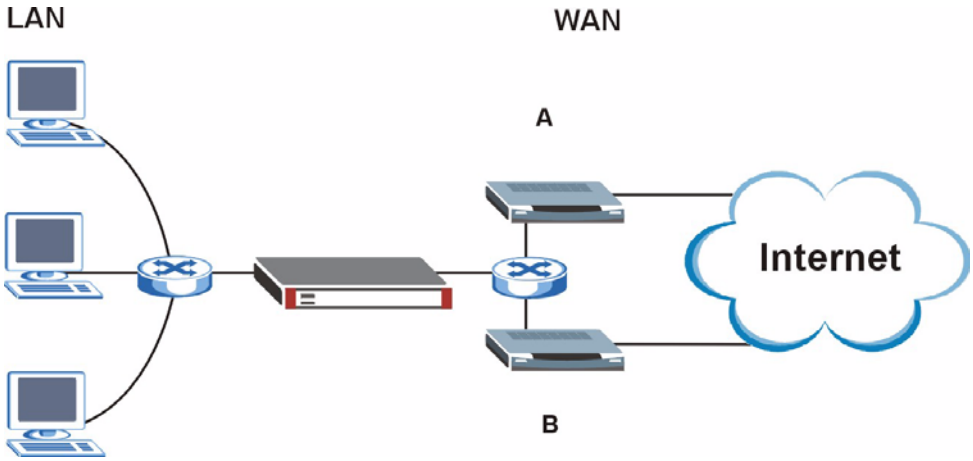
- Use `ip arp ackGratuitous active no` to have the ZyXEL Device ignore gratuitous ARP requests.
- Use `ip arp ackGratuitous active yes` to have the ZyXEL Device respond to gratuitous ARP requests.

  For example, say the regular gateway goes down and a backup gateway sends a gratuitous ARP request. If the request is for an IP address that is not already in the ZyXEL Device's ARP table, the ZyXEL Device sends an ARP request to ask which host is using the IP address. After the ZyXEL Device receives a reply from the backup gateway, it adds an ARP table entry.

  If the ZyXEL Device's ARP table already has an entry for the IP address, the ZyXEL Device's response depends on how you configure the `ip arp ackGratuitous forceUpdate` command.
  - Use `ip arp ackGratuitous forceUpdate on` to have the ZyXEL Device update the MAC address in the ARP entry.
  - Use `ip arp ackGratuitous forceUpdate off` to have the ZyXEL Device not update the MAC address in the ARP entry.

A backup gateway (as in the following graphic) is an example of when you might want to turn on the forced update for gratuitous ARP requests. One day gateway A shuts down and the backup gateway (B) comes online using the same static IP address as gateway A. Gateway B broadcasts a gratuitous ARP request to ask which host is using its IP address. If ackGratuitous is on and set to force updates, the ZyXEL Device receives the gratuitous ARP request and updates its ARP table. This way the ZyXEL Device has a correct gateway ARP entry to forward packets through the backup gateway. If ackGratuitous is off or not set to force updates, the ZyXEL Device will not update the gateway ARP entry and cannot forward packets through gateway B.

Figure 241 Backup Gateway



Updating the ARP entries could increase the danger of spoofing attacks. It is only recommended that you turn on ackGratuitous and force update if you need it like in the previous backup gateway example. Turning on the force updates option is more dangerous than leaving it off because the ZyXEL Device updates the ARP table even when there is an existing entry.

Setting the Key Length for Phase 2 IPSec AES Encryption

Syntax: `ipsec ipsecConfig encryKeyLen <0:128 | 1:192 | 2:256>`

By default the ZyXEL Device uses a 128 bit AES encryption key for phase 2 IPSec tunnels. Use this command to edit an existing VPN rule to use a longer AES encryption key.

See the following example. Say you have a VPN rule one that uses AES for the phase 2 encryption and you want it to use 192 bit encryption.

- Use the first line to start editing the VPN rule.
- The second line sets VPN rule one to use 192 bit AES for the phase 2 encryption.
- The third line displays the results.

Figure 242 Routing Command Example

```
ras> ipsec ipsecEdit 1
ras> ipsec ipsecConfig encryKeyLen 1
ras> ipsec ipsecDisplay
---------- IPSec Setup ----------
Index #= 1     Active= No    Multi Pro = No    Protocol= 0 Global SW= 0xA
Bound IKE 9999   NailUp = No   Netbios = No   Name= test

ControlPing = No  LogControlPing = No  Control ping address = 0.0.0.0
Local:  Addr Type= SINGLE      Port Start= 0         End= N/A
        IP Addr Start= 0.0.0.0              Mask= N/A
Remote: Addr Type= SINGLE      Port Start= 0         End= N/A
        IP Addr Start= 0.0.0.0              Mask= N/A
Enable Replay Detection= No    Key Management= IKE
Phase 2 - Active Protocol= ESP
          Encryption Algorithm= AES    Authentication Algorithm= SHA1
          Encryption Key Length = 192
          SA Life Time (Seconds)= 28800
          Encapsulation= Tunnel   Perfect Forward Secrecy (PFS)= None
ras>
```

F

NetBIOS Filter Commands

The following describes the NetBIOS packet filter commands. See Appendix E on page 349 for information on the command structure.

Introduction

NetBIOS (Network Basic Input/Output System) are TCP or UDP broadcast packets that enable a computer to connect to and communicate with a LAN.

For some dial-up services such as PPPoE or PPTP, NetBIOS packets cause unwanted calls.

You can configure NetBIOS filters to do the following:

- Allow or disallow the sending of NetBIOS packets from the LAN to the WAN and from the WAN to the LAN.
- Allow or disallow the sending of NetBIOS packets through VPN connections.
- Allow or disallow NetBIOS packets to initiate calls.

Display NetBIOS Filter Settings

Syntax: `sys filter netbios disp`

This command gives a read-only list of the current NetBIOS filter modes for The ZyXEL Device.

NetBIOS Display Filter Settings Command Example

```
=========== NetBIOS Filter Status ===========
        Between LAN and WAN: Block
              IPSec Packets: Forward
        Trigger Dial: Disabled
```

The filter types and their default settings are as follows.

Table 143 NetBIOS Filter Default Settings

NAME	DESCRIPTION	EXAMPLE
Between LAN and WAN	This field displays whether NetBIOS packets are blocked or forwarded between the LAN and the WAN.	Block
IPSec Packets	This field displays whether NetBIOS packets sent through a VPN connection are blocked or forwarded.	Forward
Trigger dial	This field displays whether NetBIOS packets are allowed to initiate calls. Disabled means that NetBIOS packets are blocked from initiating calls.	Disabled

NetBIOS Filter Configuration

```
Syntax:sys filter netbios config <type> <on|off>
```

where

`<type>  =`	Identify which NetBIOS filter (numbered 0-3) to configure. 0 = Between LAN and WAN 3 = IPSec packet pass through 4 = Trigger Dial
`<on|off>  =`	For type 0 and 1, use on to enable the filter and block NetBIOS packets. Use off to disable the filter and forward NetBIOS packets. For type 3, use on to block NetBIOS packets from being sent through a VPN connection. Use off to allow NetBIOS packets to be sent through a VPN connection. For type 4, use on to allow NetBIOS packets to initiate dial backup calls. Use off to block NetBIOS packets from initiating dial backup calls.

Example commands

`sys filter netbios config 0 on`	This command blocks LAN to WAN and WAN to LAN NetBIOS packets.
`sys filter netbios config 3 on`	This command blocks IPSec NetBIOS packets.
`sys filter netbios config 4 off`	This command stops NetBIOS commands from initiating calls.

G

Internal SPTGEN

This appendix introduces Internal SPTGEN. All menus shown in this appendix are example menus meant to show SPTGEN usage. Actual menus for your product may differ.

Internal SPTGEN Overview

Internal SPTGEN (System Parameter Table Generator) is a configuration text file useful for efficient configuration of multiple ZyXEL Devices. Internal SPTGEN lets you configure, save and upload multiple menus at the same time using just one configuration text file – eliminating the need to navigate and configure individual screens for each ZyXEL Device. You can use FTP to get the Internal SPTGEN file. Then edit the file in a text editor and use FTP to upload it again to the same device or another one. See the following sections for details.

The Configuration Text File Format

All Internal SPTGEN text files conform to the following format:

```
<field identification number = field name = parameter values allowed =
input>,
```

where <input> is your input conforming to <parameter values allowed>.

The figure shown next is an example of an Internal SPTGEN text file.

Figure 243 Configuration Text File Format: Column Descriptions

```
/ Menu 1 General Setup
 10000000 = Configured                <0(No)| 1(Yes)>       = 1
 10000001 = System Name               <Str>                 = Your Device
 10000002 = Location                  <Str>                 =
 10000003 = Contact Person's Name     <Str>                 =
 10000004 = Route IP                  <0(No)| 1(Yes)>       = 1
 10000005 = Route IPX                <0(No)| 1(Yes)>       = 0
 10000006 = Bridge                   <0(No)| 1(Yes)>       = 0
```

DO NOT alter or delete any field except parameters in the Input column.

This appendix introduces Internal SPTGEN. All menus shown in this appendix are example menus meant to show SPTGEN usage. Actual menus for your product may differ.

Internal SPTGEN File Modification - Important Points to Remember

Each parameter you enter must be preceded by one "="sign and one space.

Some parameters are dependent on others. For example, if you disable the **Configured** field in menu 1 (see Figure 243 on page 357), then you disable every field in this menu.

If you enter a parameter that is invalid in the **Input** column, the ZyXEL Device will not save the configuration and the command line will display the **Field Identification Number**. Figure 244 on page 358, shown next, is an example of what the ZyXEL Device displays if you enter a value other than "0" or "1" in the **Input** column of **Field Identification Number** 1000000 (refer to Figure 243 on page 357).

Figure 244 Invalid Parameter Entered: Command Line Example

```
field value is not legal error:-1
ROM-t is not saved, error Line ID:10000000
reboot to get the original configuration
Bootbase Version: V2.02 | 2/22/2001 13:33:11
RAM: Size = 8192 Kbytes
FLASH: Intel 8M *2
```

The ZyXEL Device will display the following if you enter parameter(s) that *are* valid.

Figure 245 Valid Parameter Entered: Command Line Example

```
Please wait for the system to write SPT text file(ROM-t)...
Bootbase Version: V2.02 | 2/22/2001 13:33:11
RAM: Size = 8192 Kbytes
FLASH: Intel 8M *2
```

Internal SPTGEN FTP Download Example

1. Launch your FTP application.
2. Enter "`bin`". The command "`bin`" sets the transfer mode to binary.
3. Get "`rom-t`" file. The command "`get`" transfers files from the ZyXEL Device to your computer. The name "`rom-t`" is the configuration filename on the ZyXEL Device.
4. Edit the "`rom-t`" file using a text editor (do not use a word processor). You must leave this FTP screen to edit.

Figure 246 Internal SPTGEN FTP Download Example

```
c:\ftp 192.168.1.1
220 PPP FTP version 1.0 ready at Sat Jan 1 03:22:12 2000
User (192.168.1.1:(none)):
331 Enter PASS command
Password:
230 Logged in
ftp>bin
200 Type I OK
ftp> get rom-t
ftp>bye
c:\edit rom-t
(edit the rom-t text file by a text editor and save it)
```

You can rename your "rom-t" file when you save it to your computer but it must be named "rom-t" when you upload it to your ZyXEL Device.

Internal SPTGEN FTP Upload Example

1. Launch your FTP application.
2. Enter "bin". The command "bin" sets the transfer mode to binary.
3. Upload your "rom-t" file from your computer to the ZyXEL Device using the "put" command. computer to the ZyXEL Device.
4. Exit this FTP application.

Figure 247 Internal SPTGEN FTP Upload Example

```
c:\ftp 192.168.1.1
220 PPP FTP version 1.0 ready at Sat Jan 1 03:22:12 2000
User (192.168.1.1:(none)):
331 Enter PASS command
Password:
230 Logged in
ftp>bin
200 Type I OK
ftp> put rom-t
ftp>bye
```

Example Internal SPTGEN Menus

This section provides example Internal SPTGEN menus.

Table 144 Abbreviations Used in the Example Internal SPTGEN Screens Table

ABBREVIATION	MEANING
FIN	Field Identification Number
FN	Field Name
PVA	Parameter Values Allowed
INPUT	An example of what you may enter
*	Applies to the ZyXEL Device.

Table 145 Menu 1 General Setup

/ Menu 1 General Setup			
FIN	FN	PVA	INPUT
10000000 =	Configured	<0(No) | 1(Yes)>	= 0
10000001 =	System Name	<Str>	= Your Device
10000002 =	Location	<Str>	=
10000003 =	Contact Person's Name	<Str>	=
10000004 =	Route IP	<0(No) | 1(Yes)>	= 1
10000006 =	Bridge	<0(No) | 1(Yes)>	= 0

Table 146 Menu 3

/ Menu 3.1 General Ethernet Setup			
FIN	FN	PVA	INPUT
30100001 =	Input Protocol filters Set 1		= 2
30100002 =	Input Protocol filters Set 2		= 256
30100003 =	Input Protocol filters Set 3		= 256
30100004 =	Input Protocol filters Set 4		= 256
30100005 =	Input device filters Set 1		= 256
30100006 =	Input device filters Set 2		= 256
30100007 =	Input device filters Set 3		= 256
30100008 =	Input device filters Set 4		= 256
30100009 =	Output protocol filters Set 1		= 256
30100010 =	Output protocol filters Set 2		= 256
30100011 =	Output protocol filters Set 3		= 256
30100012 =	Output protocol filters Set 4		= 256
30100013 =	Output device filters Set 1		= 256
30100014 =	Output device filters Set 2		= 256
30100015 =	Output device filters Set 3		= 256
30100016 =	Output device filters Set 4		= 256

Table 146 Menu 3

/ Menu 3.2 TCP/IP and DHCP Ethernet Setup			
FIN	FN	PVA	INPUT
30200001 =	DHCP	<0(None) | 1(Server) | 2(Relay)>	= 0
30200002 =	Client IP Pool Starting Address		= 192.168.1.33
30200003 =	Size of Client IP Pool		= 32
30200004 =	Primary DNS Server		= 0.0.0.0
30200005 =	Secondary DNS Server		= 0.0.0.0
30200006 =	Remote DHCP Server		= 0.0.0.0
30200008 =	IP Address		= 172.21.2.200
30200009 =	IP Subnet Mask		= 16
30200010 =	RIP Direction	<0(None) | 1(Both) | 2(In Only) | 3(Out Only)>	= 0
30200011 =	Version	<0(Rip-1) | 1(Rip-2B) |2(Rip-2M)>	= 0
30200012 =	Multicast	<0(IGMP-v2) | 1(IGMP-v1) | 2(None)>	= 2
30200013 =	IP Policies Set 1 (1~12)		= 256
30200014 =	IP Policies Set 2 (1~12)		= 256
30200015 =	IP Policies Set 3 (1~12)		= 256
30200016 =	IP Policies Set 4 (1~12)		= 256
/ Menu 3.2.1 IP Alias Setup			
FIN	FN	PVA	INPUT
30201001 =	IP Alias 1	<0(No) | 1(Yes)>	= 0
30201002 =	IP Address		= 0.0.0.0
30201003 =	IP Subnet Mask		= 0
30201004 =	RIP Direction	<0(None) | 1(Both) | 2(In Only) | 3(Out Only)>	= 0
30201005 =	Version	<0(Rip-1) | 1(Rip-2B) |2(Rip-2M)>	= 0
30201006 =	IP Alias #1 Incoming protocol filters Set 1		= 256
30201007 =	IP Alias #1 Incoming protocol filters Set 2		= 256

Table 146 Menu 3

30201008 =	IP Alias #1 Incoming protocol filters Set 3		= 256
30201009 =	IP Alias #1 Incoming protocol filters Set 4		= 256
30201010 =	IP Alias #1 Outgoing protocol filters Set 1		= 256
30201011 =	IP Alias #1 Outgoing protocol filters Set 2		= 256
30201012 =	IP Alias #1 Outgoing protocol filters Set 3		= 256
30201013 =	IP Alias #1 Outgoing protocol filters Set 4		= 256
30201014 =	IP Alias 2 <0(No) | 1(Yes)>		= 0
30201015 =	IP Address		= 0.0.0.0
30201016 =	IP Subnet Mask		= 0
30201017 =	RIP Direction	<0(None) | 1(Both) | 2(In Only) | 3(Out Only)>	= 0
30201018 =	Version	<0(Rip-1) | 1(Rip-2B) |2(Rip-2M)>	= 0
30201019 =	IP Alias #2 Incoming protocol filters Set 1		= 256
30201020 =	IP Alias #2 Incoming protocol filters Set 2		= 256
30201021 =	IP Alias #2 Incoming protocol filters Set 3		= 256
30201022 =	IP Alias #2 Incoming protocol filters Set 4		= 256
30201023 =	IP Alias #2 Outgoing protocol filters Set 1		= 256
30201024 =	IP Alias #2 Outgoing protocol filters Set 2		= 256
30201025 =	IP Alias #2 Outgoing protocol filters Set 3		= 256
30201026 =	IP Alias #2 Outgoing protocol filters Set 4		= 256
*/ Menu 3.5 Wireless LAN Setup			
FIN	FN	PVA	INPUT
30500001 =	ESSID		Wireless
30500002 =	Hide ESSID	<0(No) | 1(Yes)>	= 0
30500003 =	Channel ID	<1|2|3|4|5|6|7|8|9|10|11|12|13>	= 1

Table 146 Menu 3

30500004 =	RTS Threshold	<0 ~ 2432>	= 2432
30500005 =	FRAG. Threshold	<256 ~ 2432>	= 2432
30500006 =	WEP	<0(DISABLE) | 1(64-bit WEP) | 2(128-bit WEP)>	= 0
30500007 =	Default Key	<1|2|3|4>	= 0
30500008 =	WEP Key1		=
30500009 =	WEP Key2		=
30500010 =	WEP Key3		=
30500011 =	WEP Key4		=
30500012 =	Wlan Active	<0(Disable) | 1(Enable)>	= 0
30500013 =	Wlan 4X Mode	<0(Disable) | 1(Enable)>	= 0
*/ MENU 3.5.1 WLAN MAC ADDRESS FILTER			
FIN	FN	PVA	INPUT
30501001 =	Mac Filter Active	<0(No) | 1(Yes)>	= 0
30501002 =	Filter Action	<0(Allow) | 1(Deny)>	= 0
30501003 =	Address 1		= 00:00:00:00:00:00
30501004 =	Address 2		= 00:00:00:00:00:00
30501005 =	Address 3		= 00:00:00:00:00:00
Continued	…		…
30501034 =	Address 32		= 00:00:00:00:00:00

Table 147 Menu 4 Internet Access Setup

/ Menu 4 Internet Access Setup			
FIN	FN	PVA	INPUT
40000000 =	Configured	<0(No) | 1(Yes)>	= 1
40000001 =	ISP	<0(No) | 1(Yes)>	= 1
40000002 =	Active	<0(No) | 1(Yes)>	= 1

Table 147 Menu 4 Internet Access Setup (continued)

40000003 =	ISP's Name		= ChangeMe
40000004 =	Encapsulation	<2(PPPOE) | 3(RFC 1483)| 4(PPPoA)| 5(ENET ENCAP)>	= 2
40000005 =	Multiplexing	<1(LLC-based) | 2(VC-based)	= 1
40000006 =	VPI #		= 0
40000007 =	VCI #		= 35
40000008 =	Service Name	<Str>	= any
40000009 =	My Login	<Str>	= test@pqa
40000010 =	My Password	<Str>	= 1234
40000011 =	Single User Account	<0(No) | 1(Yes)>	= 1
40000012 =	IP Address Assignment	<0(Static)|1(Dynamic)>	= 1
40000013 =	IP Address		= 0.0.0.0
40000014 =	Remote IP address		= 0.0.0.0
40000015 =	Remote IP subnet mask		= 0
40000016 =	ISP incoming protocol filter set 1		= 6
40000017 =	ISP incoming protocol filter set 2		= 256
40000018 =	ISP incoming protocol filter set 3		= 256
40000019 =	ISP incoming protocol filter set 4		= 256
40000020 =	ISP outgoing protocol filter set 1		= 256
40000021 =	ISP outgoing protocol filter set 2		= 256
40000022 =	ISP outgoing protocol filter set 3		= 256
40000023 =	ISP outgoing protocol filter set 4		= 256
40000024 =	ISP PPPoE idle timeout		= 0
40000025 =	Route IP	<0(No) | 1(Yes)>	= 1
40000026 =	Bridge	<0(No) | 1(Yes)>	= 0
40000027 =	ATM QoS Type	<0(CBR) | (1 (UBR)>	= 1
40000028 =	Peak Cell Rate (PCR)		= 0
40000029 =	Sustain Cell Rate (SCR)		= 0
40000030 =	Maximum Burst Size(MBS)		= 0
40000031=	RIP Direction	<0(None) | 1(Both) | 2(In Only) | 3(Out Only)>	= 0

Table 147 Menu 4 Internet Access Setup (continued)

40000032=	RIP Version	<0(Rip-1) | 1(Rip-2B) |2(Rip-2M)>	= 0
40000033=	Nailed-up Connection	<0(No) |1(Yes)>	= 0

Table 148 Menu 12

/ Menu 12.1.1 IP Static Route Setup			
FIN	FN	PVA	INPUT
120101001 =	IP Static Route set #1, Name	<Str>	=
120101002 =	IP Static Route set #1, Active	<0(No) |1(Yes)>	= 0
120101003 =	IP Static Route set #1, Destination IP address		= 0.0.0.0
120101004 =	IP Static Route set #1, Destination IP subnetmask		= 0
120101005 =	IP Static Route set #1, Gateway		= 0.0.0.0
120101006 =	IP Static Route set #1, Metric		= 0
120101007 =	IP Static Route set #1, Private	<0(No) |1(Yes)>	= 0
/ Menu 12.1.2 IP Static Route Setup			
FIN	FN	PVA	INPUT
120108001 =	IP Static Route set #8, Name	<Str>	=
120108002 =	IP Static Route set #8, Active	<0(No) |1(Yes)>	= 0
120108003 =	IP Static Route set #8, Destination IP address		= 0.0.0.0
120108004 =	IP Static Route set #8, Destination IP subnetmask		= 0
120108005 =	IP Static Route set #8, Gateway		= 0.0.0.0
120108006 =	IP Static Route set #8, Metric		= 0
120108007 =	IP Static Route set #8, Private	<0(No) |1(Yes)>	= 0

Table 149 Menu 15 SUA Server Setup

/ Menu 15 SUA Server Setup			
FIN	FN	PVA	INPUT
150000001 =	SUA Server IP address for default port		= 0.0.0.0
150000002 =	SUA Server #2 Active	<0(No) | 1(Yes)>	= 0
150000003 =	SUA Server #2 Protocol	<0(All)|6(TCP)|17(UDP)>	= 0
150000004 =	SUA Server #2 Port Start		= 0
150000005 =	SUA Server #2 Port End		= 0
150000006 =	SUA Server #2 Local IP address		= 0.0.0.0

Table 149 Menu 15 SUA Server Setup (continued)

150000007 =	SUA Server #3 Active	<0(No) | 1(Yes)>	= 0
150000008 =	SUA Server #3 Protocol	<0(All)|6(TCP)|17(UDP)>	= 0
150000009 =	SUA Server #3 Port Start		= 0
150000010 =	SUA Server #3 Port End		= 0
150000011 =	SUA Server #3 Local IP address		= 0.0.0.0
150000012 =	SUA Server #4 Active	<0(No) | 1(Yes)>	= 0
150000013 =	SUA Server #4 Protocol	<0(All)|6(TCP)|17(UDP)>	= 0
150000014 =	SUA Server #4 Port Start		= 0
150000015 =	SUA Server #4 Port End		= 0
150000016 =	SUA Server #4 Local IP address		= 0.0.0.0
150000017 =	SUA Server #5 Active	<0(No) | 1(Yes)>	= 0
150000018 =	SUA Server #5 Protocol	<0(All)|6(TCP)|17(UDP)>	= 0
150000019 =	SUA Server #5 Port Start		= 0
150000020 =	SUA Server #5 Port End		= 0
150000021 =	SUA Server #5 Local IP address		= 0.0.0.0
150000022 =	SUA Server #6 Active	<0(No) | 1(Yes)> = 0	= 0
150000023 =	SUA Server #6 Protocol	<0(All)|6(TCP)|17(UDP)>	= 0
150000024 =	SUA Server #6 Port Start		= 0
150000025 =	SUA Server #6 Port End		= 0
150000026 =	SUA Server #6 Local IP address		= 0.0.0.0
150000027 =	SUA Server #7 Active	<0(No) | 1(Yes)>	= 0
150000028 =	SUA Server #7 Protocol	<0(All)|6(TCP)|17(UDP)>	= 0.0.0.0
150000029 =	SUA Server #7 Port Start		= 0
150000030 =	SUA Server #7 Port End		= 0
150000031 =	SUA Server #7 Local IP address		= 0.0.0.0
150000032 =	SUA Server #8 Active	<0(No) | 1(Yes)>	= 0
150000033 =	SUA Server #8 Protocol	<0(All)|6(TCP)|17(UDP)>	= 0
150000034 =	SUA Server #8 Port Start		= 0
150000035 =	SUA Server #8 Port End		= 0
150000036 =	SUA Server #8 Local IP address		= 0.0.0.0
150000037 =	SUA Server #9 Active	<0(No) | 1(Yes)>	= 0
150000038 =	SUA Server #9 Protocol	<0(All)|6(TCP)|17(UDP)>	= 0
150000039 =	SUA Server #9 Port Start		= 0
150000040 =	SUA Server #9 Port End		= 0

Table 149 Menu 15 SUA Server Setup (continued)

150000041 =	SUA Server #9 Local IP address		= 0.0.0.0
150000042	= SUA Server #10 Active	<0(No) | 1(Yes)>	= 0
150000043 =	SUA Server #10 Protocol	<0(All)|6(TCP)|17(UDP)>	= 0
150000044 =	SUA Server #10 Port Start		= 0
150000045 =	SUA Server #10 Port End		= 0
150000046 =	SUA Server #10 Local IP address		= 0.0.0.0
150000047 =	SUA Server #11 Active	<0(No) | 1(Yes)>	= 0
150000048 =	SUA Server #11 Protocol	<0(All)|6(TCP)|17(UDP)>	= 0
150000049 =	SUA Server #11 Port Start		= 0
150000050 =	SUA Server #11 Port End		= 0
150000051 =	SUA Server #11 Local IP address		= 0.0.0.0
150000052 =	SUA Server #12 Active	<0(No) | 1(Yes)>	= 0
150000053 =	SUA Server #12 Protocol	<0(All)|6(TCP)|17(UDP)>	= 0
150000054 =	SUA Server #12 Port Start		= 0
150000055 =	SUA Server #12 Port End		= 0
150000056 =	SUA Server #12 Local IP address		= 0.0.0.0

Table 150 Menu 21.1 Filter Set #1

/ Menu 21 Filter set #1			
FIN	FN	PVA	INPUT
210100001 =	Filter Set 1, Name	<Str>	=
/ Menu 21.1.1.1 set #1, rule #1			
FIN	FN	PVA	INPUT
210101001 =	IP Filter Set 1,Rule 1 Type	<2(TCP/IP)>	= 2
210101002 =	IP Filter Set 1,Rule 1 Active	<0(No)|1(Yes)>	= 1
210101003 =	IP Filter Set 1,Rule 1 Protocol		= 6
210101004 =	IP Filter Set 1,Rule 1 Dest IP address		= 0.0.0.0
210101005 =	IP Filter Set 1,Rule 1 Dest Subnet Mask		= 0
210101006 =	IP Filter Set 1,Rule 1 Dest Port		= 137
210101007 =	IP Filter Set 1,Rule 1 Dest Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 1
210101008 =	IP Filter Set 1,Rule 1 Src IP address		= 0.0.0.0
210101009 =	IP Filter Set 1,Rule 1 Src Subnet Mask		= 0
210101010 =	IP Filter Set 1,Rule 1 Src Port		= 0

Table 150 Menu 21.1 Filter Set #1 (continued)

210101011 =	IP Filter Set 1,Rule 1 Src Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 0
210101013 =	IP Filter Set 1,Rule 1 Act Match	<1(check next)|2(forward)|3(drop)>	= 3
210101014 =	IP Filter Set 1,Rule 1 Act Not Match	<1(check next)|2(forward)|3(drop)>	= 1
/ Menu 21.1.1.2 set #1, rule #2			
FIN	FN	PVA	INPUT
210102001 =	IP Filter Set 1,Rule 2 Type	<2(TCP/IP)>	= 2
210102002 =	IP Filter Set 1,Rule 2 Active	<0(No)|1(Yes)>	= 1
210102003 =	IP Filter Set 1,Rule 2 Protocol		= 6
210102004 =	IP Filter Set 1,Rule 2 Dest IP address		= 0.0.0.0
210102005 =	IP Filter Set 1,Rule 2 Dest Subnet Mask		= 0
210102006 =	IP Filter Set 1,Rule 2 Dest Port		= 138
210102007 =	IP Filter Set 1,Rule 2 Dest Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 1
210102008 =	IP Filter Set 1,Rule 2 Src IP address		= 0.0.0.0
210102009 =	IP Filter Set 1,Rule 2 Src Subnet Mask		= 0
210102010 =	IP Filter Set 1,Rule 2 Src Port		= 0
210102011 =	IP Filter Set 1,Rule 2 Src Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 0
210102013 =	IP Filter Set 1,Rule 2 Act Match	<1(check next)|2(forward)|3(drop)>	= 3
210102014 =	IP Filter Set 1,Rule 2 Act Not Match	<1(check next)|2(forward)|3(drop)>	= 1

Table 151 Menu 21.1 Filer Set #2

/ Menu 21.1 filter set #2,			
FIN	FN	PVA	INPUT
210200001 =	Filter Set 2, Nam	<Str>	= NetBIOS_WAN
/ Menu 21.1.2.1 Filter set #2, rule #1			
FIN	FN	PVA	INPUT

Table 151 Menu 21.1 Filer Set #2 (continued)

210201001 =	IP Filter Set 2, Rule 1 Type	<0(none)|2(TCP/IP)>	= 2
210201002 =	IP Filter Set 2, Rule 1 Active	<0(No)|1(Yes)>	= 1
210201003 =	IP Filter Set 2, Rule 1 Protocol		= 6
210201004 =	IP Filter Set 2, Rule 1 Dest IP address		= 0.0.0.0
210201005 =	IP Filter Set 2, Rule 1 Dest Subnet Mask		= 0
210201006 =	IP Filter Set 2, Rule 1 Dest Port		= 137
210201007 =	IP Filter Set 2, Rule 1 Dest Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 1
210201008 =	IP Filter Set 2, Rule 1 Src IP address		= 0.0.0.0
210201009 =	IP Filter Set 2, Rule 1 Src Subnet Mask		= 0
210201010 =	IP Filter Set 2, Rule 1 Src Port		= 0
210201011 =	IP Filter Set 2, Rule 1 Src Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 0
210201013 =	IP Filter Set 2, Rule 1 Act Match	<1(check next)|2(forward)|3(drop)>	= 3
210201014 =	IP Filter Set 2, Rule 1 Act Not Match	<1(check next)|2(forward)|3(drop)>	= 1
/ Menu 21.1.2.2 Filter set #2, rule #2			
FIN	FN	PVA	INPUT
210202001 =	IP Filter Set 2, Rule 2 Type	<0(none)|2(TCP/IP)>	= 2
210202002 =	IP Filter Set 2, Rule 2 Active	<0(No)|1(Yes)>	= 1
210202003 =	IP Filter Set 2, Rule 2 Protocol		= 6
210202004 =	IP Filter Set 2, Rule 2 Dest IP address		= 0.0.0.0
210202005 =	IP Filter Set 2, Rule 2 Dest Subnet Mask		= 0
210202006 =	IP Filter Set 2, Rule 2 Dest Port		= 138
210202007 =	IP Filter Set 2, Rule 2 Dest Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 1
210202008 =	IP Filter Set 2, Rule 2 Src IP address		= 0.0.0.0
210202009 =	IP Filter Set 2, Rule 2 Src Subnet Mask		= 0

Table 151 Menu 21.1 Filer Set #2 (continued)

210202010 =	IP Filter Set 2,Rule 2 Src Port		= 0
210202011 =	IP Filter Set 2, Rule 2 Src Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 0
210202013 =	IP Filter Set 2, Rule 2 Act Match	<1(check next)|2(forward)|3(drop)>	= 3
210202014 =	IP Filter Set 2, Rule 2 Act Not Match	<1(check next)|2(forward)|3(drop)>	= 1

Table 152 Menu 23 System Menus

*/ Menu 23.1 System Password Setup			
FIN	FN	PVA	INPUT
230000000 =	System Password		= 1234
*/ Menu 23.2 System security: radius server			
FIN	FN	PVA	INPUT
230200001 =	Authentication Server Configured	<0(No) | 1(Yes)>	= 1
230200002 =	Authentication Server Active	<0(No) | 1(Yes)>	= 1
230200003 =	Authentication Server IP Address		= 192.168.1.32
230200004 =	Authentication Server Port		= 1822
230200005 =	Authentication Server Shared Secret		= 1111111111111111 1111111111111111
230200006 =	Accounting Server Configured	<0(No) | 1(Yes)>	= 1
230200007 =	Accounting Server Active	<0(No) | 1(Yes)>	= 1
230200008 =	Accounting Server IP Address		= 192.168.1.44
230200009 =	Accounting Server Port		= 1823
230200010 =	Accounting Server Shared Secret		= 1234
*/ Menu 23.4 System security: IEEE802.1x			
FIN	FN	PVA	INPUT
230400001 =	Wireless Port Control	<0(Authentication Required) |1(No Access Allowed) |2(No Authentication Required)>	= 2
230400002 =	ReAuthentication Timer (in second)		= 555

Table 152 Menu 23 System Menus (continued)

230400003 =	Idle Timeout (in second)		= 999
230400004 =	Authentication Databases	<0(Local User Database Only) |1(RADIUS Only) |2(Local,RADIUS) |3(RADIUS,Local)>	= 1
230400005 =	Key Management Protocol	<0(8021x) |1(WPA) |2(WPAPSK)>	= 0
230400006 =	Dynamic WEP Key Exchange	<0(Disable) |1(64-bit WEP) |2(128-bit WEP)>	= 0
230400007 =	PSK =		=
230400008 =	WPA Mixed Mode	<0(Disable) |1(Enable)>	= 0
230400009 =	Data Privacy for Broadcast/ Multicast packets	<0(TKIP) |1(WEP)>	= 0
230400010 =	WPA Broadcast/Multicast Key Update Timer		= 0

Table 153 Menu 24.11 Remote Management Control

/ Menu 24.11 Remote Management Control			
FIN	FN	PVA	INPUT
241100001 =	TELNET Server Port		= 23
241100002 =	TELNET Server Access	<0(all)|1(none)|2(Lan)|3(Wan)>	= 0
241100003 =	TELNET Server Secured IP address		= 0.0.0.0
241100004 =	FTP Server Port		= 21
241100005 =	FTP Server Access	<0(all)|1(none)|2(Lan)|3(Wan)>	= 0
241100006 =	FTP Server Secured IP address		= 0.0.0.0
241100007 =	WEB Server Port		= 80
241100008 =	WEB Server Access	<0(all)|1(none)|2(Lan) |3(Wan)>	= 0
241100009 =	WEB Server Secured IP address		= 0.0.0.0

Command Examples

The following are example Internal SPTGEN screens associated with the ZyXEL Device's command interpreter commands.

Table 154 Command Examples

	FIN	FN	PVA	INPUT
/ci command (for annex a): wan adsl opencmd				
	FIN	FN	PVA	INPUT
	990000001 =	ADSL OPMD	<0(glite)|1(t1.413)|2(gdmt)|3(multimode)>	= 3
/ci command (for annex B): wan adsl opencmd				
	FIN	FN	PVA	INPUT
	990000001 =	ADSL OPMD	<0(etsi)|1(normal)|2(gdmt)|3(multimode)>	= 3

H

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The device complies with Part 15 of FCC rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operations.

This device has been tested and found to comply with the limits for a Class B digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This device generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this device does cause harmful interference to radio/television reception, which can be determined by turning the device off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

1. Reorient or relocate the receiving antenna.
2. Increase the separation between the equipment and the receiver.
3. Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
4. Consult the dealer or an experienced radio/TV technician for help.

FCC Radiation Exposure Statement

- This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
- IEEE 802.11b or 802.11g operation of this product in the U.S.A. is firmware-limited to channels 1 through 11.
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